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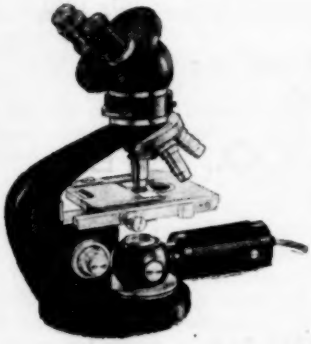

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WHY SOCIAL SCIENCES ?

IN the words of Professor Joad, "Until our social wisdom is able to cope with our mechanical skill and we learn to live up to the challenge of our new powers, the discoveries of science will tend to our discomfiture rather than to our good".[1] The above is obviously no exaggeration; for, while there is a large, consistent and continuous wave of scientific discoveries and technical inventions which any age could be proud of, there has also been apparently a serious lack of what Adler called *social interest*, with the result that the discrepancy between the ideals and realities of our social life is rather painful. With all the abundant possibilities for human comfort and happiness, it can scarcely be claimed that the modern man is finding life any the easier or happier. The promise of science to make man not only wiser and cleverer but also richer and happier is not only unfulfilled, but definite tendencies towards an opposite effect are discernible.

Clearly enough, this impasse may be attributed to what sociologists would call a 'cultural lag', *i.e.*, some aspects of our life have changed more quickly than the others and this has resulted in an obvious imbalance and maladjustment. The rise of the mechanical philosophy which was till recent years very fashionable, no doubt stirred up vigorously our scientific activity and provided the attitude necessary for the growth of science. But in dogmatising that "the objects of the scientists' real world have size, shape, motion, but there is no colour, scent, beauty in that world; there is no purpose, no emotion, no love",[2] it precluded human considerations altogether. It would appear that even when in the late 19th century man got interested in the working of his own mind and the science of psychology was born, it was more or less coloured by the same spirit.

Meanwhile, the social structure was changing rather rapidly. With the mounting of inventions and their increasing utilisation, life also

became more complicated; and this process is even now going on at a bewildering speed. This complexity in human life was a social phenomenon and the nineteenth century scientist was not interested in it. Matters came to a head when the political sovereigns directed scientists to apply their knowledge for maximum efficiency in war. The result was shocking; and so for the first time in the history of science, the scientist has begun to seriously concern himself about his obligations to society. The impact of science on society has since then become a matter for serious thinking and the tendency to-day is to harness the fruits of scientific research to the best advantage of both science and society. In this connection, MacIver has suggested that "with specialization and complexity, and the rapid tempo of change that accompany them, new attitudes are required, as a precondition to successful adjustment".[3] Obviously, this change in the attitude is not yet an accomplished fact.

The confusion prevailing to-day has been recognised to be largely due to the conspicuous absence of social sciences. In fact, Professor Joad complains that "our social sciences lag so far behind our physical and chemical sciences, that we are increasingly unable to distribute the goods we so abundantly produce".[4] Also, Herman Levy has pleaded for "sociological understanding, and power to control and guide the forces of society".[5] It is being increasingly felt that the man of science must know the science of man; and that he has a social obligation to discharge. As Professor P. W. Bridgman remarks "the *subject* is obviously so terribly important".[6]

Indeed, it is this recognition that has necessitated and encouraged the development of social sciences; for, social structure, motive, ideal, organisation, function and interaction all fall within the scope of these sciences. Society is a dynamic, living organism with peculiar modes of existence and with laws of its own. "The task of social science is to find guiding threads of principle through the infinite variety of processes and activities which make up social life."[7] They start and end, with "people, who are many, in their social relations, which are manifold". Among the major branches of social sciences might be mentioned (*a*) psychology, the study of man's mind and behaviour, (*b*) economics, the study of man's material goods, (*c*) demography, the study of population changes, (*d*) anthropology, the study of 'primitive' societies, (*e*) sociology, the study of social relations and institutions, (*f*) politics, the study of governments, and (*g*) history. Each of these contributes its own share to the total study of man in society and how he came to be what he is. And as Professor Bridgman has shown,[8] the scientific methods of analysis and description are applicable to the study of man also—only the conditions here are not so easy to tackle.

Thus it becomes necessary for the 'pure' scientist to recognise that the study of social sciences is indispensable for an insight into the social implications so obviously involved in the subject of his study, and also to realise that such a study is almost of the same category as his own, and finally to appreciate that if 'pure' science is to have any survival value, it should come from social sciences. Indeed, what can be more desirable than that science must be pressed into the service of man, and that the ideal must be maximum happiness in the social and individual life of man? A suggestion cited by Sir Josiah Stamp "to co-operate scientific, social and industrial phases of invention, and to reduce the lag between invention and application"[9] thus deserves the careful consideration of every earnest thinker on whom devolves the responsibility for promoting the greatest welfare of the greatest number.

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1. Joad, C. E. M., *Guide to Modern Thought*. 2. Taylor, E. S., *Science Past and Present*, p. 113. 3. MacIver, R. M., *Society, A Textbook of Sociology*, p. 524. 4. *Op. cit.*, p. 179. 5. *The Web of Thought and Action*, p. 238. 6. *Reflections of a Physicist*, p. 310. 7. MacIver, *Elements of Social Science*, p. 12. 8. *Op. cit.*, p. 303 f. 9. *The Science of Social Adjustment*, p. 69.

THE ISOLATION OF THE 2, 4-DINITROPHENYLHYDRAZONE OF 'GLUTAMIC ACID SEMIALDEHYDE' FROM THE ACID HYDROLYSATE OF PERIODATE-TREATED GELATIN

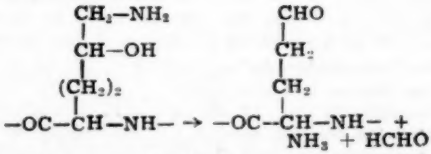
L. K. RAMACHANDRAN AND P. S. SARMA

(University Biochemical Laboratory, Madras)

PERIODATE oxidation of serine results in the formation of one mole of ammonia, one mole of formaldehyde and one mole glyoxalic acid per mole of serine.[1] In the case of threonine, however, one mole of ammonia and one mole of formaldehyde result, the other reaction product being apparently glyoxalic acid.[2] It is thought that malonic semialdehyde, resulting from the oxidation of β-hydroxyglutamic acid, being a β-aldehyde, is likely to be decarboxylated yielding acetaldehyde.[3] However, β-hydroxyglutamic acid is an unusual protein constituent. Speaking generally, the aldehydo acids arising from the periodate oxidation of hydroxy-amino acids, have not so far been much studied.[4]

In the case of hydroxylysine (1, 6-diamino-5-hydroxy caproic acid) periodate oxidation was found to yield one mole of ammonia and one mole of formaldehyde per mole of the amino acid.[5] This has been confirmed by various workers.[6-11] The other reaction product is expected to be glutamic semialdehyde, $OHC\text{-}CH_2\text{-}CH_2\text{-}CH(NH_2)\text{-}COOH$, whose existence may be doubted since it would cyclise easily. The compound is not, in fact, listed in literature even though it has been recently suggested as an intermediate in protein metabolism. For some time, we have tried to isolate this aldehyde as a derivative, under favourable experimental conditions.

The technique consists in the treatment of intact gelatin in aqueous solution with periodic acid under optimum conditions, when one mole of ammonia and one mole of formaldehyde would be split off, leaving the glutamic semialdehyde bound in peptide linkage in the protein molecule itself:



This scheme was based on our observation[11] that all the functional groups of hydroxylysine in gelatin are free, at least as far as the reaction with periodate was concerned, based on analyses of the hydroxylysine content of the native protein and its hydrolysate, and on the further observation that a sulphuric acid hydrolysate of periodate-treated gelatin does not contain any hydroxylysine as analysed by the method of Van Slyke[5] and Macpherson.[6] In the face of such evidence, the recent suggestion[12] that the amino-acid may be bound to the protein molecule by an amide linkage at the ϵ-position lacks experimental support. The treated protein was hydrolysed under reducing conditions ($SnCl_2$-HCl), the hydrochloric acid and the stannous ion removed, treated with 2, 4-dinitrophenylhydrazine and the hydrazone formed extracted with ethyl acetate and recrystallised.

A neutralised sulphuric acid hydrolysate of the treated gelatin contained no hydroxylysine, possibly due to oxidation of the aldehyde to glutamic acid under the experimental conditions of autoclaving for effecting the hydrolysis, and yielded no crystalline semicarbazone after suitable treatment. It was further found that from a sample of a $SnCl_2$-HCl hydrolysate, answering the phenylhydrazone colour test, the aldehydo-acid could be extracted fairly efficiently at a pH of 7-8 with ether. But on the large-scale the extraction at pH 7·5 with ether was extremely difficult due to absence of a clear separation of the layers in the presence of the small amounts of precipitated $Sn(OH)_2$. Even after the removal of the tin as stannous sulphide the ether was not found to extract the aldehydo acid efficiently. Where the 2, 4-dinitrophenylhydrazine treatment was carried out prior to the removal of the tin the hydrazone was found to be strongly absorbed and carried down by the precipitate of stannous sulphide and could not be extracted.

The experimental details which yielded finally the pure crystalline hydrazone are indicated below.

EXPERIMENTAL

200 g. gelatin (Kodak brand, moist, Analysing 1·08% hydroxylysine as percentage of the total nitrogen by the periodate-NH_3 method applied to the intact protein[11]) were dissolved in 1,200 c.c. warm water (60° C.), cooled to R.T. and the following reagents added in order with thorough mixing during and after each addition: 100 c.c. 2 N NaOH, 100 c.c. 0·15 M HIO_4 and 100 c.c. saturated potassium carbonate solution. The

mass was well stirred. During the addition of the potassium carbonate solution the mass turned highly viscous. It was left to stand at 37° C. for 4 hrs., during which period, there was a definite fall in viscosity. It was now placed in the centre compartment of a three-compartment wax-coated wooden cell, the compartments being separated by parchment paper and the side compartments being filled with distilled water to the same level. Carbon electrodes were placed one in each of these and connected through a proper resistance to a 220 volts D.C. main so as to get a final current strength of 0·5 amp. The electrodialysis was carried out for a period of 68-92 hrs. until the treated gelatin in the centre compartment was absolutely free of all electrolytes. The contents of the side compartments were replaced by fresh distilled water at intervals. The gelatin solution was found to have regained its original reaction at the end of this period.

1 litre of concentrated hydrochloric acid containing 10 g. stannous chloride was added to the electrodialysed gelatin the mixture placed in a 3 litre bolt head flask and gently boiled under reflux on a Babo air-bath for 16 hrs. After the hydrolysis the whole was concentrated to a volume of 250 c.c. under reduced pressure and diluted to 4 litre with water and treated with H_2S. The precipitated tin sulphide was removed by filtration and the filtrate and washings concentrated to 2 litres. To this was added, 3 g. 2, 4-dinitrophenylhydrazine and the whole heated at 100° C. on a steam-bath for 15 min. Afterwards it was cooled down and concentrated under reduced pressure to a volume of 500 c.c. and the hydrazone present extracted with ethyl acetate. The combined extracts were dried with anhydrous sodium sulphate. Most of the extract was evaporated at room temperature to remove the ethyl acetate and the crude residue recrystallised from ethanol after norit treatment. The reddish orange highly crystalline hydrazone weighed nearly 400 mg. Previous trials had shown that most other organic solvents used in the recrystallisation of 2, 4-dinitrophenylhydrazones were not helpful in the present case. The hydrazone had the m.p. 119-20° (Uncorr.) and under the microscope the crystals appeared needle-shaped and in clusters.

Analysis.—N content determined by Pregl's micro method—22·56% ; Do. calculated for $C_9H_4N_4O_4C_5H_9NO_2$—22·5%. Molecular weight by Rast's method was found to be 308, while the value calculated for the above formula is 311·2.

Another small portion of the ethyl acetate extract was applied to an alumina column (30 × 2 cm.) packed with the help of ethyl acetate. The column was developed by further addition of ethyl acetate and eluted with the same solvent under a pressure head of 25 mm. Hg. There were observed a fast moving yellow diffuse zone corresponding to the unreacted reagent and a slower moving but sharply defined single reddish brown band. The latter was eluted out and the eluate on evaporation again yielded the hydrazone with the m.p. 119-20°.

Thus the 2, 4-dinitrophenylhydrazone isolated, and analysed as above, appears to correspond to that of glutamic semialdehyde, the melting points of the 2, 4-dinitrophenylhydrazones of most of the other commoner aldehydes being quite different. It is to be expected that further confirmation regarding the identity of this third periodate oxidation product from hydroxylysine would become available since four methods have recently been reported for the synthesis of hydroxylysine.[12-14] Further, the isolation and characterisation of this compound would be easier with pure synthetic hydroxylysine.

Acknowledgment.—One of us (L. K. R.) wishes to thank the University of Madras for a Research Studentship during the tenure of which this work was carried out.

1. Nicolet, B. H. and Shinn, L. A., *J. Am. Chem. Soc.*, 1939, **61**, 1615. 2. Idem, *J. Biol. Chem.*, 1941, **138**, 98. 3. —, *Ibid.*, 1942, **142**, 139. 4. Hotchkiss, R. D., *Ibid.*, 1941, **141**, 171. 5. Van Slyke, D. D., Hiller, A. and Macfadyen, D. A., *Ibid.*, 1941, **141**, 681. 6. Macpherson, H. T., *Biochem. J.*, 1946, **40**, 470. 7. Heathcote, J. G., *Ibid.*, 1948, **42**, 305. 8. Desnuelle, P. and Antonin, A., *Biochem. et Biophys. Acta.*, 1947, **1**, 50. 9. Idem, *Helv. Chim. Acta.*, 1946, **29**, 1306. 10. Martin, A. J. P. and Synge, R. L. M., *Biochem. J.*, 1941, **35**, 294. 11. Ramachandran, L. K., Unpublished. 12. Zyl, G. V., van Tamelen, E. E. and Zuidema, G. D., *J. Am. Chem. Soc.*, 1951, **73**, 1765. 13. Weisiger, J. R., *J. Biol. Chem.*, 1950, **186**, 591. 14. Sheehan, J. C. and Bolhofer, W. A., *J. Am. Chem. Soc.* 1950, **72**, 2472.

INDIAN ACADEMY OF SCIENCES

THE Seventeenth Annual Session of the Indian Academy of Sciences was held at the University of Delhi from 27th to 30th December, 1951. Professor Sir C. V. Raman presided over the session. President Rajendra Prasad, who inaugurated the session, stressed that scientists should devote their time and energy, their intellect and knowledge, for the welfare of the common man. The Presidential Address of Professor Raman was devoted to the "Structure and Properties of Silica". He mentioned in particular the optical rotation of crystalline quartz and revealed that recent researches in his Institute by Mr. S. Chandrasekhar have led to a new formula for the rotatory dispersion of the crystal and that this formula may lead to a better understanding of the mechanism of optical rotation of quartz and also of crystals in general.

A special feature of the sectional meetings was the interesting symposium on the *Physics of Thunderstorms* in which several members of the Meteorological Department and the Directorate of Civil Aviation took part. The subjects dealt with were the thermodynamics and electrical aspects of thunderstorms and also their bearing on the structure of aircraft. There were also public lectures by Prof. P. Maheswari on 'Botany and Our Food Supply', and by Prof. Sir C. V. Raman on the 'Electrical Properties of Crystals'.

Professors P. W. Bridgman, R. A. Daly, H. von Euler-Chelpin and K. H. Meyer were elected Honorary Fellows, and B. S. Chauhan, R. L. M. Ghose, C. P. Gnanamuthu, A. R. Gopal Aiyengar, N. S. Govinda Rao, D. R. Malhotra, S. M. Mehta, S. Raghavendra Rao, P. S. Sarma and B. D. Tilak were elected Ordinary Fellows of the Academy, during the session.

INDIAN MATHEMATICAL SOCIETY

THE Seventeenth Biennial Conference of the Indian Mathematical Society was held at Bangalore under the auspices of the University of Mysore on the 22nd, 23rd and 24th December, 1951. Sir C. V. Raman delivered the Inaugural Address. In his Presidential Address to the Sesssion, Dr. T. Vijayaraghavan referred to the present position of mathematical research in India, and discussed the needful requisites for effecting an over-all improvement. The mathematical part of his address was concerned with some problems on Summability and Tauberian Theorems as also problems in the Theory of Numbers.

A Mathematical Exhibition, showing models of various geometrical surfaces including surfaces that are met with in differential geometry, charts and models relating to topology (knots, four-colour problem, etc.), and diagrams of geometrical constructions were arranged in the Department of Mathematics, Central College.

About 30 papers were presented to the Conference. Besides the discussion on these, there were three Symposia on (1) Bourbaki, (2) Geometry of Numbers and (3) The Role of Mathematics in Engineering, the last of which was held at the Indian Institute of Science. There were two popular lectures, one by Sir C. V. Raman, on "The Scattering of Light in Crystals", and the other by Dr. H. J. Bhabha who made a general survey of the entire field of mathematical physics and referred to the part played by mathematics in the development of physics.

C. N. S.

LADY TATA MEMORIAL TRUST
SCIENTIFIC RESEARCH SCHOLARSHIPS, 1952-53

THE Trustees of the Lady Tata Memorial Trust are offering six Scholarships of Rs. 250 each per month for 1952-53 commencing from July 1, 1952. Applicants must be of Indian nationality and Graduates in Medicine or Science of a recognised University. The Scholarships are tenable in India only and the holders must undertake to work wholetime under the direction of the Head of a Scientific Department in a recognised Research Institute or Laboratory on a subject of scientific investigation that must have a bearing either directly or indirectly on the alleviation of human suffering from disease. Applications must conform to the instructions drawn up by the Trustees and must be received before 15th March 1952. Candidates can obtain these instructions and other information they desire from the Secretary, The Lady Tata Memorial Trust, Bombay House, Bruce Street, Fort, Bombay 1.

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BAND SPECTRUM OF OXIDES OF CALCIUM AND MAGNESIUM

A detailed study of the visible and near ultraviolet bands associated with the oxides of calcium[1,2,3] and magnesium[4] is reported here with a view to improve upon the present state of our knowledge of these molecules.

The bands of calcium oxide were produced by introducing it in the cavity on the lower electrode of a carbon as well as a copper arc in air. The magnesium oxide bands were produced by burning small strips of magnesium ribbons in air and also by running an arc in air with magnesium electrodes. The spectra were photographed on a Hilger E_1 Quartz spectrograph as well as in the 1st, 2nd, 3rd and 4th orders of a 3-metre concave grating having a dispersion of approx. 6 A per mm. in the 1st order.

MgO Green and Ultra-Violet Bands: The wavelengths obtained in the present measurements significantly differ from those reported previously. Barrow's data for the (2, 0) sequence agree with the present ones but in addition prominent band heads at λ air 4779·65; 4762·18; 4756·10; 4747·80; 4736·14 Å, have also been observed. As for the bands in the (0, 0) sequence, some of the present measurements agree with those of Mahanti,[1] while the rest do not. Besides the band heads obtained by Barrow, a number of additional bands have been observed; of these the bands with heads at λ 3,966·89, 3,981·31, 3,994·55, 4,007·56 and 4,019·97 Å appear to belong to one sequence.

Barrow observed the bands only up to λ 3,594 Å. In the present experiment the lower wavelength limit has been extended to λ 2,936 Å.

CaO Blue Bands: A large number of band heads have been measured but only those with wavelengths at λ 4,567·8, 4,530·2, 4,351·2, 3,994·5, 3,977·0, 3,773·7, 3,712·2, 3,656·6 Å can be reported with confidence. Measurements of other

band heads differ significantly from those of Mahanti and Brodersen and it is difficult to say whether they are genuine band heads or are just aggregates of lines giving false impression of band heads.

The rotational structure of some of the bands of CaO in the ultra-violet, orange and green region and of magnesium oxide in the green and ultra-violet have also been measured. Full details of the work will be published elsewhere.

My thanks are due to Prof. L. M. Chatterjee and Dr. S. P. Sinha for their kind interest and to the Patna University for the award of a Research Scholarship.

Physics Department, J. K. PATNAIK.
Science College,
Patna,
November 3, 1951.

1. Mahanti, P. C., *Phys. Rev.*, **1932**, **42**, 609. 2. Brodersen, P. H., *Zeits. f. Phys.*, **1936**, **104**, 135. 3. Pearse, R. W. B., and Gaydon, A. G., *The identification of Molecular Spectra*, **1941**, published by Chapman and Hall Ltd., London, 93-95. 4. Barrow, R. F., *Proc. Phys. Soc.*, **1945**, **57**, 12.

X-RAY STUDY OF THE STRUCTURE OF SILVER AMALGAMS

THE crystal structure of silver amalgam has been studied by various authors using the X-ray[1,2,3] and electron diffraction[4,5,6] methods. Even in cases where the amalgam is prepared in the same manner, the two methods give results widely different from each other. The previous investigators have, however, confined themselves only to powder photographs. In the present investigation, the powder method was used with amalgams prepared by the following methods:

(*a*) by directly mixing silver filings with mercury.
(*b*) by the action of a solution of silver nitrate on mercury.
(*c*) by the electrolysis of silver, using a cyanide bath.
(*d*) by the action of a saturated solution of mercuric chloride on thin silver foil.
(*e*) by boiling mercury with pieces of silver foil in *vacuo*.
(*f*) by the action of a solution of silver nitrate and cuprous iodide in anhydrous pyridine, on a drop of mercury.[7]

Also single crystals of amalgam produced by the method (*b*) were studied by the rotation method. This is the first time that X-ray studies have been made with single crystals of silver amalgams. The results are given below:

TABLE

Method of preparation	% wt. of silver	Phase	a_0 in A.
a	27·59	γ	9·955
b	16·17	γ	9·983
c	17·04	γ	9·986
c	26·99	γ	10·019
c	27·98	γ	10·021
c	28·40	γ	9·998
c	37·50	γ	10·013
		α	4·064
c	48·22	γ	10·027
		α	4·083
c	61·30	γ	10·008
		α	4·076
d	..	γ	10·006
e	..	γ	10·00
f	..	γ	10·027
b	..	γ	10·063+

+ Single crystal investigation.

The calibration of the camera radius was done by using rock-salt as the standard. The values of the lattice constants given are correct to about 0·2%. The third decimal place is given for information.

Preston and others working on amalgams with varying contents of silver, ranging from 25% to 100% (prepared by directly mixing silver and mercury), report that when the silver content is about 30%, the amalgam shows a body-centred cubic structure (γ-phase). When it is between 30% and 40%, the γ-phase exists simultaneously with the hexagonal close-packed structure (β-phase), and between 40% and 50%, the β-phase exists along with the α-phase of free silver, while beyond 50% only the α-phase is found. On the other hand, the present investigations, summarised in the above Table, show that: (1) the γ-phase starts even at 16% of silver, existing in equilibrium along with free mercury phase, (2) there is no evidence at any stage of the appearance of the β-phase, (3) the γ-phase persists even above 35% of silver along with the α-phase. These results differ from those of earlier workers, which is probably due to the fact that the methods of preparation are different.

The chemical formula corresponding to the crystals of the γ-phase (suggested variously as Ag_2Hg_3, Ag_3Hg_4, Ag_4Hg_5, etc.), is yet to be definitely established by a detailed analysis. Further work on the subject is in progress and the details will be published elsewhere. One of

us (T. G. S.) is indebted to the Government of India for the award of a Research Scholarship.

First Grade College, Tumkur, S. RAMA SWAMY.
Central College, Bangalore, T. G. SHAMANNA.
November 14, 1951.

1. Preston, *J. Inst. Metels*, 1931, **46**, 522. 2. Stenbeck, *Z. anorg. allgem. Chem.*, 1933, **214**, 16-26. 3. Weryha, *Z. Krist.*, 1933, **86**, 335-39. 4. Aylmer, etc., *Trans. Faraday Soc.*, 1936, **32**, Part 8, 864-71. 5. Pinsker and Tatarinova, *Acta Physicochim. U.R.S.S.*, 1941, **14**, 193-200. 6. Shishakov, *Bull. acad. sci. U.R.S.S., Classe Sci. Chim.*, 1941, 683-9. 7. Müller and Hönig, *Z. anorg. allgem. Chem.*, 1922, **121**, 344-46.

THIRD ORDER ELASTIC COEFFICIENTS OF ISOTROPIC SOLIDS

FUMI[1] recently obtained the third order elastic coefficients for all the thirty-two point groups. For a cubic crystal, these reduce to six independent coefficients and may be described by the following relations:

$$C_{111} = C_{222} = C_{333}$$
$$C_{112} = C_{133} = C_{223} = C_{113} = C_{332} = C_{122}$$
$$C_{144} = C_{366} = C_{255}$$
$$C_{166} = C_{244} = C_{355} = C_{344} = C_{266} = C_{155}$$
$$C_{123}$$
$$C_{456}$$

In the case of isotropic solids, there are three further relations between these six, namely,

$$C_{166} = 3\,C_{111} - C_{112}$$
$$C_{123} = 2\,C_{112} - C_{144}$$
$$C_{456} = 2\,(C_{166} - C_{144})$$

Thus the number of independent coefficients reduces to three. That this number is only three for an isotropic solid is well known.[2] In this note we give the actual surviving coefficients.

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Dept. of Mathematical Physics,
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Waltair,
December 3, 1951.

1. Fumi, F. G., *Phy. Rev.*, 1951, **83**, 1274. 2. Jahn, H. A., *Acta. Cryst.*, 1949, **2**, 30.

HEAT CONDUCTIVITY—VISCOSITY RELATIONSHIP FOR LIQUIDS AT THE FREEZING POINT OF WATER

IT has been shown by the author[1] that the coefficient of heat conductivity K and that of viscosity η for a liquid are related in the form

$$MK/\eta = 3R, \qquad 1\ (a)$$

where M is the molecular weight of the liquid and R the gas constant. Since R in calories is very nearly 2,

$$MK/\eta = 6; \qquad 1\ (b)$$

K is in calories and η in poises. The possibility of correction of the numerical coefficient in 1 (*a*), similar to that applied to the kinetic theory equation connecting K and η for a gas, is not excluded. This relation was applied at the boiling point *b.p.* (a 'corresponding' temperature), when it was found[5] that, for a number of liquids,

$$MK_{bp}/\eta_{bp} = \text{Constant} = 10{\cdot}8.$$

The derivation of the above relationship postulates, after Andrade,[8] a model for the liquid state in which the molecules are regarded as executing vibrations as in a solid. The chief difference between the two states is that in the former the amplitudes of the vibrations are large enough for the molecules to collide with neighbours at every extreme displacement. Equations 1 (*a*) and 1 (*b*) should, therefore, be valid only at the freezing point, since at this temperature the liquid structure approximates, most closely, to the above picture.

In recent years, K for water has been measured, at a number of temperatures in the range 0-80° C. by Jakob,[2] Kaye and Higgins,[3] Martin and Lang,[4] and Bates.[5] Values for K at 0° C., the freezing point of the liquid, due to the above workers are respectively 0·001325, 0·00145, 0·001394 and 0·00134 calories. We select for the followig calculations the value due to Bates,[4] *viz.*, 0·00134. The viscosity of water at this temperature as given by Bingham and Jackson[6] is 0·01792 poise. Water is an 'associated' liquid, and therefore M in the equations 1 (*a*) and 1 (*b*) should be replaced by nM, where n is the 'association factor'. This last for the liquid at 0° C. is 4·18 (Macleod[7]). Therefore,

$$n\text{MK}_f/\eta_f = 5{\cdot}6,$$

a value in good agreement with the theoretical value, *viz.*, 6.

Dept. of Chemistry, S. R. MOHANTY.
Benares Hindu University,
November 11, 1951.

1. Mohanty, *Nature*, 1951, **168**, 42. 2. Jakob, *Ann. der Phys.*, 1920, **63**, 537. 3. Kaye and Higgins, *Proc. Roy. Soc.*, 1928, **A117**, 459. 4. Martin and Lang. *Proc. Phys. Soc.*, 1933, **45**, 523. 5. Bates, *Ind. and Eng. Chem., Ind. Edn*, 1936, **28**, 494. 6. Bingham and Jackson, *Bull. Bur. Stds*, 1918, **14**, 75. 7. Macleod, *Trans. Faraday Soc.*, 1925-26, **21**, 145. 8. Andrade, *Phil. Mag.*, 1934, **17**, 497.

STUDIES IN CATALYTIC OXIDATION OF ETHYLENE TO ETHYLENE OXIDE

THE catalytic oxidation of ethylene to ethylene oxide employing a static bed of catalyst has been the subject of a number of patents and a few publications.[1-4] Promoted silver oxide deposited on metallic or non-metallic supports has been mainly employed as the catalyst. Though the use of refractory materials like fused alumina, fire brick, sandstone and artificial silica, as catalyst supports has been mentioned in patent literature, the only significant published work is that of McBee, *et. al.*,[3] who have employed synthetic corundum as the carrier. A conversion of 30% (on the basis of ethylene fed) and a selectivity of 45% for ethylene oxide are reported at a space velocity of 1,500 with an air-ethylene ratio of 17·5.

In this reaction, besides ethylene oxide, carbon dioxide has been found to be invariably formed as the product. The reactions leading to the formation of both ethylene oxide and carbon dioxide are exothermic. As a result of this, the temperature of the catalyst bed rises to values far beyond the optimum. High temperatures lead to the excessive production of carbon dioxide and thus to poor yields of ethylene oxide. So, it is essential that the catalyst bed be maintained within narrow temperature limits during operation. Considering the various advantages offered by the Fluidized Bed Technique, particularly, the high heat transfer coefficients, uniform heat distribution and rigid temperature control, a study of the above reaction employing this technique was undertaken.

Lack of comprehensive data on the various aspects of this reaction using non-metallic supports compelled us to undertake, as a first step, a thorough investigation of the reaction in the static bed also.

Precipitated silver oxide promoted with barium peroxide and deposited on various non-metallic carriers was employed as the catalyst. The effect of variables, *viz.*, promoter concentration, temperature, space velocity and air-ethylene ratio was studied in each case.

The incorporation of barium peroxide to silver oxide was found to be essential for good adherence of the catalyst on the support. Besides, it improved the performance of the catalyst.

It was found that with the increase in the concentration of barium peroxide the adherence of the catalyst on the carrier improved (Table I). But when the concentration of barium peroxide was above 10 per cent. the optimum temperature rose to 300° C. and the selectivity decreased.

TABLE I

Concentration of $Ag_2O = 0·453$ gm./c.c. of quartz

No.	BaO_2 on the wt. of Ag_2O, per cent.	Space velocity, c.c./hr./c.c.	Air-C_2H_4 ratio	Optimum bath temp., °C.	Total conversion, per cent.	Selectivity of ethylene oxide, per cent.	Space-time yield, c.c./hr./c.c.
1	6·0	1500	11·2	260	48·5	58·2	34·7
2	10·2	1570	11·0	260	46·1	59·7	36·5
3	17·8	1565	12·8	300	49·9	41·0	25·1

TABLE II

Concentration of $Ag_2O = 0·453$ gm./c.c. of carrier
Concentration of $BaO_2 = 6·0$ per cent. on the weight of Ag_2O.

No.	Catalyst support	Space velocity, c.c./hr./c.c.	Air-C_2H_4 ratio	Optimum bath temp., °C.	Total conversion per cent.	Selectivity of ethylene oxide, per cent.	Space-time yield, c.c./hr./c.c.
1	Natural corundum	1400	10·6	260	36·5	32·9	14·0
2	Do	3020	24·6	260	26·9	46·7	14·8
3	Pumice	1480	10·3	260	33·3	41·7	18·2
4	Do	2980	20·2	260	25·9	49·5	18·0
5	Kieselguhr	1510	10·7	280	12·7	32·1	4·6
6	Activated alumina	1525	21·2	210	29·6	negligible	
7	Quartz	1500	11·2	260	48·5	58·2	34·7
8	Do	2915	23·3	270	42·9	55·1	28·3

It is evident from the data presented in Table II that the conversion and the selectivity are best in the case of quartz supported catalyst, are best in the case of the quartz supported catalyst.

The results of these investigations may be summarized as follows:

(i) The general behaviour of the catalyst is independent of the nature of the support employed.

(ii) The fresh catalyst is highly reactive and degradative but after continued use for about 12 hours, it attains a steady state.

(iii) Beyond the optimum temperature the yield of ethylene oxide decreases but that of carbon dioxide increases. This is due to the formation of 'hot spots'.

(iv) When the space velocity is increased the air-ethylene ratio also must be progressively increased in order to obtain good yields of ethylene oxide.

(*v*) A decrease in contact time lowers the total conversion though the selectivity remains almost the same.

The results of the investigations in the fluidized bed will be published separately.

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November 22, 1951.

1. McKin and Cambron, *Can. J. of Res.*, 1949, **27B**, 813. 2. Murray, *Aust. J. Sc. Res.*, 1950, **3**, Sec. 3, 433. 3. McBee, *et al.*, *Ind. Eng. Chem.*, 1945, **37**, 432. 4. Twigg, G. H., *Proc. Roy. Soc.*, 1946, **188**, 92.

ESTIMATION OF PHENOLPHTHALEIN

IN an investigation on the labelling of *Vanaspati* (hydrogenated fat), we found that phenolphthalein dissolves in fat and is, therefore, capable of being used as a tracer. To establish whether or not this tracer in the fat medium would be removed by treatment with animal charcoal or Fuller's earth, we had to estimate phenolphthalein, which, as originally added, was 10 mg. per cent. on the weight of fat. The gravimetric procedure of the A.O.A.C. (1), which is applicable to quantities of phenolphthalein of not less than 0·2 g., could not be used for this estimation. Nor did a review of the literature available reveal a method as would estimate accurately such small quantities of phenolphthalein in the presence of such large excess of fat. Volumetric estimation of phenolphthalein, using iodine, is the basis of the method developed by us.

Method.—To 20 mg. phenolphthalein dissolved in 25 ml. 0·25% NaOH, 10 ml. of sodium bicarbonate are added, followed by 10 ml. of iodine (0·1 N). The volume is then made up to 100 ml. Blank is done under identical conditions, but without phenolphthalein. Aliquots of the mixture within 10 minutes of the reaction are titrated as follows: to a mixture of about 190 ml. distilled water, 5 ml. of 2% starch solution, 2 ml. of 10% KI and 5 ml. of 10% H_2SO_4 contained in a 400 ml. beaker (tall form), very dilute iodine is added dropwise till a faint blue colour appears. To the medium thus prepared, a 50 ml. aliquot of the reaction mixture is run in slowly, keeping the contents of the beaker well-stirred with a glass rod, during the addition. The mixture, under stirring, is titrated against standard thio (N/50), delivered from a micro-burette. The end point is reached when the blue colour (starch-iodine) disappears and the solution becomes red (due to the precipitate of tetraiodophenolphthalein in suspension). Or, preferably, as the end point approaches, the precipitate is allowed to settle, and the colour is judged in the supernatant liquid by looking through the beaker against transmitted light.

Factor: 1 ml. 0·1 N Iodine = 0·003976 g of phenolphthalein.

In dealing with different quantities of phenolphthalein to be estimated, the reaction mixture should be made up in the above proportions in relation to the quantity of phenolphthalein present. Under these conditions, the solution is clear and has the colour of iodine solution. When bicarbonate is deficient and alkali is in excess, the colour is blue to blue-purple.

The method gives a value of 99·9% $\pm$ 0·06 (S.E.), as determined in 25 estimations, using different quantities of phenolphthalein varying from 10 mg. to 220 mg.

The usefulness of the method has been demonstrated by its successful application to the estimation of phenolphthalein in preparations. These results will be found in the fuller paper being published elsewhere.

Our thanks are due to Dr. V. Subrahmanyan, Director of the Institute, for his interest in the investigation and helpful criticisms.

Central Food Tech. Res. Inst., M. SRINIVASAN.
Mysore, V. R. BHALERAO.
October 19, 1951.

1. A.O.A.C., *Methods of Analysis*, Sixth Edition, 1945, 39, 719, 170.

ANTI-TUBERCULOUS THIOSEMICARBAZONE COMPOUNDS

THE introduction of *p*-substituted benzaldehyde thiosemicarbazones and particularly *p*-acetaminobenzaldehyde thiosemicarbazone (I) also known as TBI-698 or "Conteben" in Germany and "Tibione" in the United States, in the treatment of tuberculosis[1,2,3] has aroused considerable interest in the field of thiosemicarbazones as possible antituberculous compounds. The compound shows high activity *in vitro* and *in vivo* tests.[2,4]

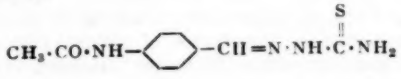
A study was started in our laboratory with the aim of preparing a few Schiff's bases, of *p*-amino-benzaldehyde thiosemicarbazone (II) by its condensation with aromatic aldehydes, which

TABLE

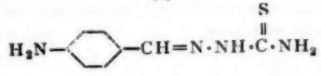
$$p\text{-X-C}_6\text{H}_4\cdot\text{CH=N·NH·}\overset{\overset{\text{S}}{\|}}{\text{C}}\text{·NH}_2$$

No.	X	Molecular formula	M.P. °C.
1	o-(O_2N)-C_6H_4-CH=N-	$C_{15}H_{13}N_5S$	194–195
2	m-O_2N-C_6H_4-CH=N-	$C_{15}H_{13}N_5S$	208–209
3	p-O_2N-C_6H_4-CH=N-	$C_{15}H_{13}N_5S$	206–207
4	p-$(CH_3)_2N$-C_6H_4-CH=N-	$C_{17}H_{19}N_5S$	209–210
5	p-$(C_2H_5)_2N$-C_6H_4-CH=N-	$C_{19}H_{23}N_5S$	192–193
6	p-CH_3O-C_6H_4-CH=N-	$C_{16}H_{16}ON_4S$	187–188
7	2, 3, 5-(OH)(I)(I)·C_6H_2-CH=N-	$C_{15}H_{12}ON_4SI_2$	229–230
8	2, 5-(OH)(Br)C_6H_3-CH=N-	$C_{15}H_{13}ON_4SBr$	223–224
9	CH_2-CO-NH- | CH_2 | COOH	$C_{12}H_{14}O_3N_4S$	210–211
10	p-CH_3-CONH-C_6H_4-SO_2-NH-	$C_{16}H_{17}O_3N_5S_2$	239–240

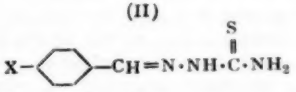
may possibly have good antituberculous activity. The amino group in (II) has also been acylated with succinic anhydride and *p*-acetaminobenzene sulphonyl chloride to give *p*-(β-carboxy propionamido) benzaldehyde thiosemicarbazone and 4-(*p*-acetaminobenzene-sulphonyl)-aminobenzaldehyde thiosemicarbazone, respectively.



(I)



(II)



(III)

Experimental.—*p*-Aminobenzaldehyde thiosemicarbazone (0·01 M.) and the corresponding aldehyde (0·01 M.) were refluxed in ethyl alcohol (50 c.c.) for a period of 1 to 2 hours. The Schiff's base which separated on cooling was filtered and washed with alcohol. The crude product was crystallised from rectified spirit.

Acylation of II with succinic anhydride and *p*-acetaminobenzene sulphonyl chloride was done in acetone and pyridine, respectively.

The compounds of the general formula (III) with their melting points are listed in the Table.

Full details will be published later. Tests for the antituberculous activity of the compounds are in progress. Thanks are due to Professor P. C. Guha for his active interest in this work.

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December 12, 1951.

1. Domagk, G., *et al.*, *Naturwissenschaften*, 1946, **33**, 315. 2. Behnisch, R., *et al.*, *Am. Rev. Tuberc.*, 1950, **61**, 1. 3. —, *Angew. Chem.*, 1948, **60**, 113. 4. Hoggarth, *et al.*, *Brit. J. Pharmacol. and Chemotherapy*, 1949, **4**, 248.

SEPARATION AND IDENTIFICATION OF AMINO ACIDS FROM PROTEIN HYDROLYSATES BY CIRCULAR PAPER CHROMATOGRAPHY

CIRCULAR paper chromatography as originally described by Giri[1] cannot be adapted to the identification of amino acids by running mixed chromatograms as in the case of widely used unidimensional chromatogram made by the "ascending" and "descending" techniques. A new technique eliminating the above limitation of this method has been developed by Giri and Rao.[2] The present communication describes an attempt to examine the possibility of the application of this technique to the identification of amino acids separated from casein hydrolysate.

The casein hydrolysate prepared by hydrolysing casein with 6 N sulphuric acid and neutralising with barium hydroxide contained 5·6 mg. of amino nitrogen per ml. 10 μ l. of the hydrolysate was spotted on the circumference of a circle drawn with a pencil from the centre of the circular filter paper. The mixture of known

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amino acids was spotted at positions marked M between the spots at positions marked H relating to the hydrolysate. The chromatogram was run and developed as described before.[1] Fig. 1 is the chromatogram illustrating the

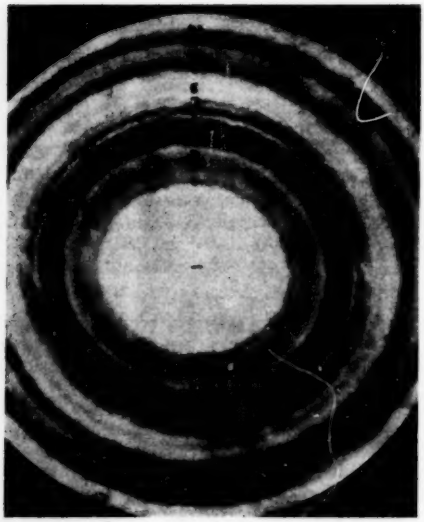

Fig. 1. Circular paper chromatogram showing the separation of amino acids in casein hydrolysate using *n*-butanol-acetic acid water as developing solvent. The hydrolysate was introduced on to the paper at the centre before the slit was cut.

separation of amino acids from casein hydrolysate spotted at the centre of the paper into at least twelve distinct circular zones each representing one or more amino acids. Fig. 2 is the mixed chromatogram of the hydrolysate and a known mixture of amino acids run on the same paper. It is clear from Fig. 2 that the amino acids present in the hydrolysate can be readily identified by reference to the arcs of the known amino acids formed on the circumference of the same circle. The presence of histidine, aspartic acid, proline, leucine, lysine, threonine, phenylalanine, arginine, glutamic acid, methionine, is indicated from Fig. 2. By running similar mixed chromatograms, glycine, serine, valine, iso-leucine, alanine, cystine and tyrosine in the casein hydrolysate have also been identified by reference to the arcs of the amino acids run on the same paper. The overlapping circular zones of amino acids with R_f values very near each other can be separated into individual zones and identified by multiple development technique.[1]

This technique is now being applied to the study of the hydrolysis of proteins by enzymes and to the amino acid analyses of normal and pathological urine, blood, and tissues.

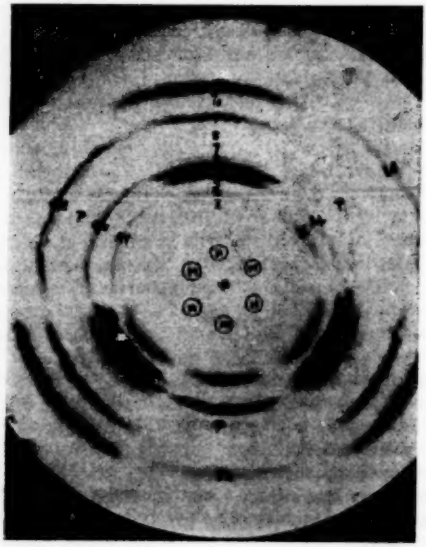

Fig. 2. Circular paper mixed chromatogram showing the separation and identification of histidine (*Hi*), aspartic acid (*Ai*), proline (*P*), leucine (*Le*), lysine (*Ly*), threonine (*Th*), phenylalanine (*Ph*), arginine (*Ar*), glutamic acid (*Glu*), and methionine (*Me*), Developing solvent: *n*-Butanol-acetic acid-water.

Added Jan. 1952

Since submitting this note we have found that instead of cutting a slit at the centre and inserting a paper strip for irrigation with the solvent as described originally, a cylindrical "wick" (2-3 mm. thickness) cut at the end into the form of a brush and inserting it into a hole (2-3 mm. diameter) made at the centre of the paper, was found to be more convenient and uniform circular zones could be obtained by this modification.

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December 17, 1951.

1. Giri, K. V., *Curr. Sci.*, 1931, **20**, 295. 2. — and Rao, N. A. N., *Nature* (communicated).

EFFECT OF DIFFERENT MECHANICAL FRACTIONS ON THE EFFICIENCY OF NITRIFYING ORGANISMS

THE nitrifying capacity of the different fractions of the manured and unmanured alluvial soil as affected by continuous cropping of wheat has been studied by adding 2·0 gm. of different fractions in 100 c.c. of Omeliansky Medium.[2] The joint effect of these fractions on nitrification was studied by mixing 2 gm. of them in the same proportion as they existed in the soil. The medium, after inoculation with pure culture of nitrifying organisms, was incubated for a fortnight. After incubation the medium was analysed for nitrate content. The results are incorporated in the following Table.

Nitrate Formed in Presence of Different Mechanical Fraction in p.p.m.

Fractions	Manured			Unmanured		
	0–6"	6"–1'	1'–2'	0–6"	6"–1'	1'–2'
Clay ..	8·02	6·96	5·15	9·52	8·39	6·12
Silt ..	5·10	4·39	3·11	6·93	6·74	3·59
Sand ..	3·75	3·12	2·93	4·12	3·57	2·63
Sand + Silt ..	4·25	4·10	3·00	5·31	4·97	3·11
Sand + Clay ..	4·95	4·53	3·27	6·29	6·00	4·39
Silt + Clay ..	5·25	5·11	4·05	6·79	6·95	5·41
Sand + Silt + Clay	6·97	5·93	4·99	7·87	7·74	6·05

It is apparent from these results that as in the case of nitrogen fixation[1] the finely divided fraction has some physiological influence on nitrification. Finer the fractions, greater is the nitrification. This phenomenon may be due to the greater surface exposed for the absorption of the nutrients. It appears that these fractions aid in nitrification by replenishing ions in the medium when they are removed by the growing organisms.

All the three mechanical fractions in general, from the unmanured plot encouraged greater nitrification than the corresponding fractions from the manured plot, clay definitely possessing greater nitrifying capacity than silt and sand in both the soils. The surface soil indicated higher activity in both the plots. When these fractions were mixed in the same proportion as they occur in soil, the maximum amount of nitrate was found when all the three, *viz.*, sand, silt and clay were present. Hence the continuous growing of wheat without manure appears to have modified the nitrifying capacity of the soil as a whole and also of the individual fractions, so that the various mechanical fractions enhanced the efficiency of nitrate producers in the unmanured soil as compared to those from the soil manured and cropped.

Chemistry Section, Govt. Agricultural College, Kanpur, A. N. PATHAK. J. G. SHRIKHANDE.

October 24, 1951.

1. Pathak, A. N., Shrikhande, J. G. and Mukerji, S. K., *Curr. Sci.*, 1951, **20**, 130. 2. Fred, E. B. and Waksman, S. A., *Laboratory Manual of General Microbiology*, 1st Ed., New York, 1928.

STUDIES ON THE THIAMINASE IN VAUNSHI (MUGIL Sp.)

THIAMINE inactivating mechanism associated with carp and certain other varieties of freshwater fish, was reported by various workers.[1–4] Recently Giri, Reddy and Das[5] have shown the presence of such a factor in fresh-water mussel. The present note deals with the distribution of thiaminase in Vaunshi (*Mugil* sp.), a brackish-water variety of edible fish which is very popular in Bombay.

Thiaminase activity was determined by incubating overnight (16 hours) the fish extract in acetate buffer (pH 5·6) with 25 μg of thiamine at room temperature (27° C.–30° C.) with toluene as a preservative and estimating the amount of thiamine left over. The amount of thiamine destroyed was a measure of thiaminase activity. Thiamine was estimated by the thiochrome method as described by Bhagwat.[6] A parallel incubation was carried out with boiled extract every time. A "Live Control", i.e., the extract without boiling and without the substrate (Thiamine) was run simultaneously but it gave negligible values.

The enzyme from 20 gm. of whole fish was extracted with 60 ml. of different solvents such as water, chloroform-water mixture, acetate buffer (pH 5·6) and 5% sodium chloride and filtrates were tested for activity. The results are given in the following Table.

Extraction of Thiaminase with Different Solvents

	Solvent	% destruction of thiamine
1	Water ..	67·2
2	Chloroform-water mixture ..	61·2
3	Acetate buffer (pH 5·6) ..	39·6
4	5% Sodium chloride solution ..	54·4

From the above Table, it is evident that water is a better and suitable solvent in the extraction of thiaminase from Vaunshi.

Effect of hydrogen-ion concentration on the inactivation of thiamine by thiaminase was studied between pH 3·0 and 7·0 using acetate and phosphate buffers. The results expressed in terms of percentage destruction of thiamine with respect to hydrogen-ion concentration are represented graphically in Fig. 1.

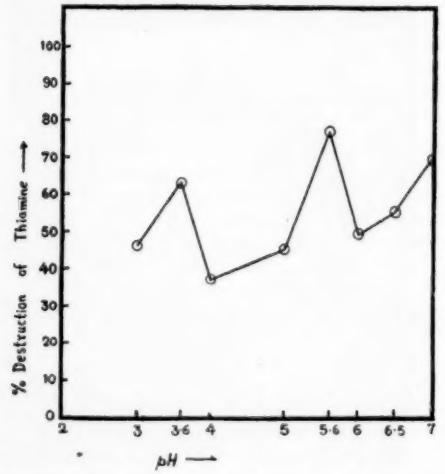

FIG. 1. Effect of pH on the Destruction of Thiamine by Thiaminase

The curve indicates that there are three different hyrogen-ion concentrations, (*viz.*, pH 3·6, 5·6 and 7·0), at which the enzyme shows optimum activity. This appears to be peculiar with this enzyme. Since carp thiaminase has been shown to exhibit optimum activity at only one pH, though the actual value for the optimum pH as reported by various workers is different, *e.g.*, pH 8·0,[2] pH 9·1[1] and at pH 6.[3] However, Giri, *et. al.*,[5] have shown the presence of two different enzymes from fresh-water mussel having optimum activity at pH 3·6 and 6·5. Thus the three optima in the pH curve with Vaunshi extract may probably be due to three enzymes exhibiting thiaminase activity.

With a view to verify this hypothesis, the effects of dialysis of the extract and the addition of certain salts were studied. It was observed that the extract lost a greater part of its activity on dialysis. The activity, however, could be restored by the addition of boiled original extract. This indicates the presence of a coenzyme. The presence of a coenzyme was reported earlier by Woolley, *et. al.*,[2] and Bhagwat, *et. al.*,[3] independently. When the effect of addition of certain salts, *viz.*, $MnSO_4$, $MgSO_4$, $ZnSO_4$ and $CuSO_4$ (M/100 concentration) to the dialysed extract was studied, it was observed that only $MnSO_4$ could restore the activity of enzyme showing optimum activity at pH 3·6 and 5·6 respectively, while none of these could restore the activity of the enzyme exhibiting optimum activity at pH 7·0. Thus the coenzyme required for the activation of the third enzyme appears to be different. In the case of fresh-water mussel, Giri, *et. al.*,[5] have shown that the enzyme with optimum activity at pH 3·6 and 6·5 could be activated by Mn^{++} salts. All the above facts lead to the conclusion that there might exist at least two sets of enzymes possessing thiaminase activity.

Further work on the isolation and purification of the enzyme is in progress.

Preliminary experiments have shown that liver and spleen are good sources of the enzyme while the amount of the enzyme in ovaries, stomach, etc., is comparatively small. The rather wide distribution of thiaminase among the tissues and organs suggests that it may have an important role in the metabolic processes of the fish.

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Bombay, KAMALA SOHONIE.
December 1, 1951.

1. Sealock, R. R., Livermore, A. H. and Evans, C. A. *J. Am. Chem. Soc.*, 1943, **65**, 935. 2. Woolley, D. W. and Krampitz, L. O., *J. Biol. Chem.*, 1944, **152**, 9. 3. Bhagwat, K. and Devi, P., *Ind. Jour. Med. Res.*, 1944, **31**, 131. 4. Deutsch, H. F. and Hasler, A. D, *Proc. Soc. Expt. Biol. Med.*, 1943, **53**, 63. 5. Giri, K. V., Reddy, K. and Das, R., *Enzymologya*, 1948, **12**, 238. 6. Bhagwat, K., *Ind. Jour. Med. Res.*, 1943, **31**, 145.

THE INFLUENCE OF BORON ON THE YIELD AND CONTENT OF CARBOHYDRATE IN TOMATO FRUITS

THE importance of boron as a plant nutrient for growing healthy plants and obtaining good quality returns has been emphasised by many workers.[1-8] It has also been shown by a few workers[1-5] that carbohydrate fractions accumulate in tomato fruits and in different parts of the plant in varying amounts, as a result of complete absence or an insufficient supply of the element. An attempt has been made to determine the extent to which carbohydrate fractions accumulate in the fruits, at different stages, with higher concentrations of the element.

TABLE I

Influence of Boron on the Yield and Content of Carbohydrate in Tomato Fruits of Different Stages

Treatments	Yield of fruits		Content of Carbohydrate fractions in different stages of the fruit (per 100 g. of the fruit)											
			Green				Yellow				Red Ripe			
	No. of fruits	Weight in lb.	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate	Reducing sugar	Non-reducing sugar	Starch	Total carbohydrate
No Boron ..	61	5·54	3·97	6·58	7·91	18·46	4·02	7·65	7·34	19·01	5·32	9·81	4·72	19·85
Boron 0·5 p.p.m.	95	8·68	3·58	5·36	7·35	16·29	3·29	6·07	6·40	16·42	4·14	6·90	4·31	15·35
,, 1·0 ,,	118	12·40	3·63	4·92	6·22	14·77	2·68	5·17	4·25	12·10	3·82	6·15	3·18	13·15
,, 2·0 ,,	123	15·27	2·76	4·31	5·89	12·96	3·10	4·42	3·97	11·49	3·20	5·24	2·30	10·74
,, 3·0 ,,	137	15·91	2·07	4·28	4·07	10·46	2·17	4·05	3·82	10·04	2·39	4·59	1·93	8·91

It is evident from Table I that boron increases considerably the yield of tomato fruits in number and weight, with increasing concentrations of the element. It is characteristically observed that the contents of starch decreases, and of the reducing and non-reducing sugars show a gradual increase as the fruit ripens. All the carbohydrate fractions decrease with increasing application of boron.

From this investigation it is obvious that boron either directly or indirectly influences not merely the formation and accumulation of different fractions of carbohydrate, but also its utilization in the normal physiological and metabolic processes in the plant.

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College of Agriculture,
Benares Hindu University,
April 26, 1951.

1. Beckenbach, J. R., *Bull. Florida Agr. Expt. Stn.*, **1944, 395,** 1-34. 2 Johnstone, E. S., and Dore, W. H., *Plant Phy.*, **1929, 4,** 31-62. 3. Johnstone, E. S., and Fisher, P. L., *Ibid.*, **1930, 5,** 387-92. 4. McHargue J. C., and Calfee, R. K., *Jour. Amer. Soc. Agron.*, **1937, 29,** 385-91. 5. Rehling, C. J., and Trough Emil, *Ibid.*, **1940, 32,** 894-906. 6 Scripture, P. N., and McHargue, J. C., *Ibid.*, **1945, 37,** 360-64. 7. Warrington, K., *Ann. Bot.*, **1923 37,** 629-72. 8. —, *Ibid.*, **1926, 40,** 27-42.

INFLUENCE OF ZINC ON TOMATO FRUITS

THE utility of zinc application to successful crop production has been adequately stressed before.[1-11] This investigation on the influence of zinc on the yield, content of ascorbic acid, and accumulation of carbohydrate in tomato fruits shows that the yield of fruit (Table I), both in number and weight increases with increasing doses of zinc, upto a limit. Due to increased availability, with 3 p.p.m. of zinc, a large number of flower buds are injured and the yield of fruit decreases. The maximum yield was obtained with 2·0 p.p.m. of zinc while with smaller concentrations, the yield was poor.

TABLE I

Influence of Zinc on the Yield and Ascorbic Acid Content in Tomato Fruits

Treatments	Yield of fruits		Vitamin C content (in mgm. E.Q. per 100 c.c. of the juice) in different stages of the fruit		
	No. of fruits	Weight in lb.	Green	Yellow	Ripe (Red)
Minus zinc	111	9·73	19·20	17·56	21·80
Zinc 0·5 p.p.m.	95	8·68	17·70	19·04	20·30
,, 1·0 ,,	144	15·92	16·60	27·08	35·20
,, 2·0 ,,	172	16·30	19·80	24·70	34·90
,, 3·0 ,,	152	11·35	18·10	21·00	29·20

The ascorbic acid content (Table I), normally increases with increasing availability of zinc but also with the ripening of fruit from green to red, and the maximum amount occurs in the fully ripened fruit. A number of workers[1,6,7] have reported an increase in Vitamin C content in tomato grown in presence of zinc than in complete absence of it.

Table II shows that different carbohydrate fractions gradually decrease with increasing concentration of zinc. The accumulation of

TABLE II

Influence of Zinc on the Accumulation of Carbohydrate in Tomato Fruits

Treatments	Content of Carbohydrate in different stages of the fruit (per 100 g. of fresh material)											
	Green				Yellow				Red Ripe			
	Reducing sugar	Total sugar	Starch	Total Carbohydrate	Reducing sugar	Total sugar	Starch	Total Carbohydrate	Reducing sugar	Total sugar	Starch	Total Carbohydrate
Minus zinc p.p.m. ..	3·91	6·61	7·48	18·00	3·27	7·03	6·91	17·21	4·33	8·79	4·82	17·94
Zinc 0·5 ,, ..	3·58	5·36	7·35	16·29	3·99	6·07	6·40	16·46	4·14	6·90	4·31	15·35
,, 1·0 ,, ..	2·23	5·34	5·03	16·60	2·70	5·82	4·46	12·98	3·07	6·43	3·04	12·54
,, 2·0 ,, ..	2·23	4·13	5·60	11·96	2·73	5·08	4·28	12·06	2·81	6·11	2·93	11·85
,, 3·0 ,, ..	2·67	3·79	4·78	11·24	2·05	4·92	3·53	10·50	2·73	5·93	2·17	10·83

reduced and non-reducing sugars gradually increase while starch decrease from green to yellow and red. The total carbohydrate content shows a decrease both with increasing availability of zinc and as the fruit ripens. It is also observed that the total carbohydrate accumulation is slightly more in the completely ripened than in the yellow both in complete absence and with 3·0 p.p.m. of the element in the culture.

Plant Physiological Lab., P. R. GOVINDAN.
College of Agriculture,
Banaras Hindu University,
May 21, 1951.

1. Hamner, K. C., *et al.*, *Bot. Gaz.*, 1942, **103**, 586-615. 2. Hass, A. R. C., *Ibid.*, 1935, **98**, 65-86. 3. Hoagland, D. R., *et al.*, *Proc. Amer. Soc. Hort. Sci.*, 1936, **33**, 131-41. 4. Loustalot, Arnaud, J., *et al.*, *Plant Phy.*, 1945, **20**, 283-88. 5. Lyon, C. B., *et al.*, *Bot. Gaz.* 1943, **104**, 495-514. 6. Lyon, C. B., and Parks, R. Q., *Ibid.*, 1944, **105**, 392-93. 7. McHargue, J. C., and Calfee, R. K., *Jour. Amer. Soc. Agron.*, 1937, **29**, 385-91. 8. Reed, H. S., *Amer. Jour. Bot.*, 1933, **26**, 29-33. 9. Rehling, C. J. and Troug, Emil, *Jour. Amer. Soc. Agron.* 1940, **32**, 894-906. 10. Stout, P. R., and Arnon, D. I., *Amer. Jour. Bot.*, 1939, **26**, 144-49. 11. Waksman, S. A. and Foster, J. W., *Compt. Rend. Acad. Sci.*, (Paris), 1938, **207**, 483-86.

INHERITANCE OF *SHORT LINT* MUTANT IN COCANADAS COTTON

THE occurrence of a new lint quantity mutant (CST 1) designated as *short lint* registering a mean combed halo length of 5 to 10 m.m. and a mean ginning outturn of 6 to 9 per cent. was reported[1] before, in Cocanadas cotton (*G. arboreum* race. *indicum*). The inheritance of the *short lint*, in crosses effected with two normal linted varieties, *viz.*, Nandyal 14 and Tellapathi and one hairy lintless mutant $(li_c - li_r)$[3] from Nandyal, belonging to the same race, is reported in this paper.

The association between *short lint* and low ginning was perfect and hence the ginning per cent. which was easier to determine and less subject to personal error than staple length was chosen as the phenotypic index to study the nature of segregation in hybrid populations Possibly, the shortening of the staple length by two-thirds, has the proportionate physical effect of lowering the ginning outturn by an equal amount. It would be therefore more appropriate to view the gene as one affecting metric length than lint density.

The data furnished in Table I reveal the *short lint*—low ginning genotype to be a simple monogenic recessive to 'normal lint'.

TABLE I

Inheritance of short lint *mutant*

Nature of material	Total number of plants with		
	Normal lint having a ginning of 16 to 29%	Short lint having a ginning of 3 to 13%	Value of P (for a mono-factorial ratio)
PARENTS			
(*a*) CST 1 ..	..	36	..
(*b*) Nandyal 14 ..	10	..	..
(*c*) Tellapathi ..	5	..	..
HYBRIDS			
(*a*) i. CST 1 × Nandyal 14 F 1	32	..	..
ii. F 1 backcross with Nandyal 14	25	..	..
iii. F 2 total of 4 families	133	53	0·2
(*b*) i. CST 1 × Tellapathi F 1	10	..	..
ii. F 2 total of 2 families	120	30	0·1

In the cross with Nandyal hairy lintless ($li_c - li_c$), the F_1 was normal with a mean halo length of 22 mm. and a mean ginning value of 4 per cent. The classification in F_2 yielded 129 'normal lint', 63 *short lint* and 35 'lintless' plants agreeing with modified dihybrid ratio of 9 : 4 : 3 ($P > 0{\cdot}3$) for complementary factors.

The symbol $li_{sh} - li_{sh}$ is now assigned to this new mutant character *short lint* found in Asiatic cotton in accordance with the accepted method of gene symbolisation in cotton. The character is simple recessive to normal lint and epistatic to li_c. Its relation to other lintless genes remains yet to be worked out. The importance of Coconada zone as a variable centre of origin for cultivated peninsular *arboreums* is strengthened by the discovery of a second new gene affecting lint quantity, but not lint density, the previous one being *'immature lint'*[2] which lowers the ginning value by low fibre weight. The *'sparse lint'*[1] on the other hand must be viewed as a gene-controlling density.

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Agric. Coll. & Res. Inst.
Coimbatore,
September 24, 1951.

1. Balasubrahmanyan, R. and Santhanam, V., *Curr. Sci.*, 1950, **19**, 60-61. 2. — and Mayandi Pillay, S., *Ind. Cott. Grow. Rev.*, 1950, **4**, 144-66. 3. Ramiah, K., *Prog. Rept. Cott. Genet. Res. Scheme, Inst. Pl. Indust. Indore*, 1944, I.C.C.C.

FIRE BLIGHT OF COSMOSH—A BACTERIAL DISEASE INCITED BY *ERWINIA COSMOVORA* N. SP.

In August, 1951, a peculiar disease was observed on *Cosmos bipinnatus* Cav. at the Agricultural Institute, Anand. The disease appeared on blossoms, sepals, leaves and twigs. The first visible symptom was the browning of the blossoms and this discolouration extended down to the pedicels. Leaves were discoloured at the margins at first and gradually the entire leaf turned brown. The affected shoots were killed. The dead leaves persisted for quite a long time and gave a charred appearance to the plant.

Sections of diseased material were examined under the microscope and the epidermal cells were invariably found to be full of rod-shaped bacteria. These bacteria were readily obtained in culture and were found to agree entirely in shape and size with those found in the tissues.

The bacteria cause a dry necrosis. This and other symptoms resemble those of fire blight of pears. The cultural characters of the bacterium, responsible for the disease, are as follows :

Rods, 0·8 to 1·0 by 1·0 to 1·5 microns occurring singly, motile, gram-negative, no endospores, capsules absent, whitish amorphous, gelatin stab ; liquefaction confined to upper layers ; agar colonies, grayish white, glistening with irregular margins, indole not produced, nitrites from nitrates, acid without gas from glucose, maltose and lactose, no action on sucrose, starch hydrolysed, no action on inulin, it does not grow in absence of organic nitrogen.

From the characters studied above, the bacterium isolated from diseased tissues of *Cosmos* belongs to the genus *Erwinia*. The characters do not conform to any of the species described in Bergey's manual.[1] It is therefore a new species and the name proposed is *E. cosmovora* n. sp.

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Anand,
October 6, 1951.

1. Bergey's *Manual of Determinative Bacteriology*, Williams and Wilkins Company, 1948.

FUSARIUM BLIGHT OF CLUSTER BEANS

During 1950, a severe epidemic of a peculiar disease appeared on cluster beans (guar), *Cyamopsis psoraloides* D.C. at the Agricultural Institute, Anand. Plants of guar in the adjoining cultivator's fields were also severely affected. The rainfall during the year 1950 was abundant, with an average of 50", while during the year 1951, a total of 14" was recorded. The disease appeared in the beginning of August, 1951, but it did not make any headway as the weather remained extremely dry.

The disease was characterised at the beginning by the appearance of thin black streaks on the stem. These streaks extended downwards and upwards. The pedicels of the leaves were also affected and gradually the affected shoot dried up. No flowers or pods were formed on these shoots. Longitudinal and transverse sections of the affected parts were cut and the fungus mycelium, was invariably observed in the outer parenchymatous tissues.

Very large number of isolations were made from affected tissues and a variety of fungi was isolated. The largest number of isolates belonged to Genus *Fusarium*. There is a good deal of variation among these isolates. Single spore

cultures of various isolates of *Fusarium* were obtained. Seedlings of guar raised in sterilized soil were inoculated with spore suspensions sprayed by means of an atomiser. After the plants were sprayed with spore suspensions, they were kept under moist condition for the next 24 hours. The symptoms of the disease appeared three weeks after inoculation. The strain with which the plants were inoculated, was reisolated from the diseased plants. The fungus which causes the disease belongs to *Fusarium moniliforme* Sheld, according to Wollenweber and Reinking's classification.[1] Its correct name under Snyder and Hansen's system would be *F. moniliforme* Sheld. emend Snyd. et. Hans.

Further work on this disease is in progress.

Plant Pathological Laboratory, N. PRASAD.
Agricultural Institute, M. V. DESAI.
Anand,
October 6, 1951.

1. Wollenweber, H. W. and Reinking, O. A., *Die Fusarien*, 1935. 2. Snyder, W. C. and Hansen, H. N., *Amer. Jour. Bot.*, 1940, **27**, 64-67. 3. —, *Ibid.*, 1941, **28**, 738-42. 4. —, *Ibid.*, 1945, **32**, 657-66.

CHITRI DISEASE OF TOBACCO IN GUJARAT

CHITRI disease of tobacco has been recorded by Uppal, Patel and Kamat as a vascular wilt caused by *Fusarium oxysporum* var. *nicotianeæ* Johns. from the Kaira District in Gujarat. They have considered it to be identical with the wilt of tobacco recorded in U.S.A. Recently Mathrani, Ellias and Kadam have studied this disease and have concluded that it is not a typical wilt and that it is probably due to a primary attack of a nematode similar to *Pratylenchus pratensis* (de Man.) Filipjev. This nematode is responsible for brown root rot of tobacco in U.S.A. These authors regard *Fusarium* and *Renzoctonia*, isolated from diseased plants as secondary parasites.

We agree with Mathrani, Ellias and Kadam that it is not a simple case of wilting but we are not in agreement with their conclusion that *Fusarium* is secondary in nature. As a result of infection studies, conducted over three seasons, we conclude that chitri is a complex of a root rot and wilt. The symptoms of the two types of diseases can be clearly seen in nature and as well as under artificial conditions. Two different species of the genus *Fusarium* are responsible for this complex.

Morphological study of the strains of the casual organisms was carried out and the one which causes wilt has been identified as *Fusarium oxysporum* f. *nicotianeæ* and the one which causes root rot is placed under *F. solani* f. *nicotianeæ*. In the determination of species of *Fusarium*, Snyder and Hansen's classification has been used.

Detailed results of the investigations carried out will be published elsewhere.

Agricultural Institute, N. PRASAD.
Anand, I. M. PATEL.
November 26, 1951.

1. Jenkins, W. A., *Phytopath*, **38**, 528-41. 2. Johnson, J., *Jour. Agri. Res.*, **20**, 515-35. 3. Mathrani, D. I., Ellias, N. A. and Kadam, B. S., *Ind. Tobacco*, 1951, **1**, 148-53. 4. Snyder, W. C. and Hansen, H. N., *Amer. Jour. Bot.*, 1940, **27**, 64-67. 5. —, *Ibid.*, 1941, **28**, 738-42

ON THE FRY OF THE MILK-FISH *CHANOS CHANOS* (FORSKAL)

IT is well known that the fry of the milkfish, *Chanos chanos* (Forskal), appear in large numbers in the tidal flats of the Pamban area, especially near the Chinnapalam Creek. Observations of Delsman[1] (1929), in the Indonesian waters have shown that the fish larvæ appear first in the summer months of April and May, and later in the months of September, October and November. The information available on the distribution of *Chanos* fry in different parts of South India has been recently summarised by Ganapathi, *et. al.*,[2] (1950), and it will be found from the Table published by them that *Chanos* fry have been recorded in most parts of the Madras State only in the summer months with the exception of the Adyar near Madras and Pulicat where they have been recorded also in the October-December periods. In Visakapatnam, *Chanos* fry are recorded up to the September period.

The observations made during the past few years in the Pamban area have not revealed the presence of *Chanos* fry in months other than April-June and it is interesting to note that on 28th November, 1951, the fry of *Chanos* were observed by us in the Chinnapalam Creek in sizes as small as 15 mm. which represent some of the earliest stages of the fry recorded in Indian waters. Fry have continued to be available for many succeeding days. While the possibility of their occurrence in the autumn months is always kept in mind as it will prove to be of great value in the culture of the milkfish, it is noteworthy that throughout the Indian coast the summer months of April-June appear to be

the principal period for them. Schuster's[3] (1951) record of young *Chanos* in Kalpitiya is also in conformity with this observation. This is very different from the behaviour of this species in Indonesian waters where the September-November period has been found to be more important.[1] It may also be added that on 16th October 1951, we obtained what is probably the first recorded adult specimen of *Chanos* from the Gulf of Manaar, which had a total length of 1,240 mm. and had spent ovaries. During the last summer months it was also possible for us to extend the places of fry collection in this area to the shores of Palk Bay in the direction of Mandapam to Theedai where the fry enter the saline lagoons adjoining Palk Bay in large numbers.

Based on ova diameter measurements, Bunag[4] (1951) has shown that *Chanos* has only one spawning season in the Philippines. In the adult *Chanos* we have examined, the ovaries are in a completely spent condition and do not indicate the possibility of protracted spawning as no part of the ovary was showing active growth of the oocytes indicative of a secondary spawning. It is possible, therefore, that so far as individual fish are concerned, there is only one spawning during the year but that the spawning period for the species is not limited to a very short period in terms of summer or autumn months. It is noteworthy, however, that there is a pronounced discontinuity in the occurrence of fry between their first appearance in the summer months and their later appearance. The Table given by Ganapathi, *et. al.*, would give the impression that in the various places the fry might occur for the April to October period, but it is not clear whether these authors have differentiated between the appearance of early stages of the fry and of the availability of the fingerlings. More information on the initial appearance of the larvæ in various regions of the coastline at different times of the year is essential for a further understanding of the habits of the fish. It is needless to add that, if a definite secondary period of spawning could be established, it is of considerable importance for the future development and expansion of milkfish culture.

Central Marine Fisheries Research Station, Mandapam, *December* 9, 1951.

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R. VISWANATHAN.

1. Delsman, H. C., "Fish eggs and larvæ from the Java Sea. 13. *Chanos chanos* (Forsk.)," *Treubia*, 1929, **11**, (2), 281-86. 2. Ganapathi, S. V., Chacko, P. I., Srinivasan, R. and Krishnamurthi, B., *Indian Geog. Jour.*, 1950-**25**, (2), 1-15. 3. Schuster, W. H., *Report on a Survey of the Inland Fisheries of Ceylon.* Sessional Paper 24. Ceylon Govt. Press, 1951, 1-15. 4. Bunag, D. M., *Indo-Pacific Fisheries Council, 3rd Meeting, Madras. Tech. Paper* No. 16 (Abstract).

MICROSPOROGENESIS AND MALE GAMETOPHYTE IN *ELEUSINE CORACANA* GAERT.

IN the course of an investigation on the embryology of the millet *Eleusine coracana* Gaert., certain observations were made on the development of the pollen which seem worthy of record.

The anthers are bisporangiate and quadrilocular in cross-section. The pollen mother cells are surrounded by a glandular tapetum of binucleate cells, a middle layer which gets obliterated at an early stage, an endothecium developing fibrous thickenings and an epidermis containing attenuated cytoplasm and nuclei, when mature.

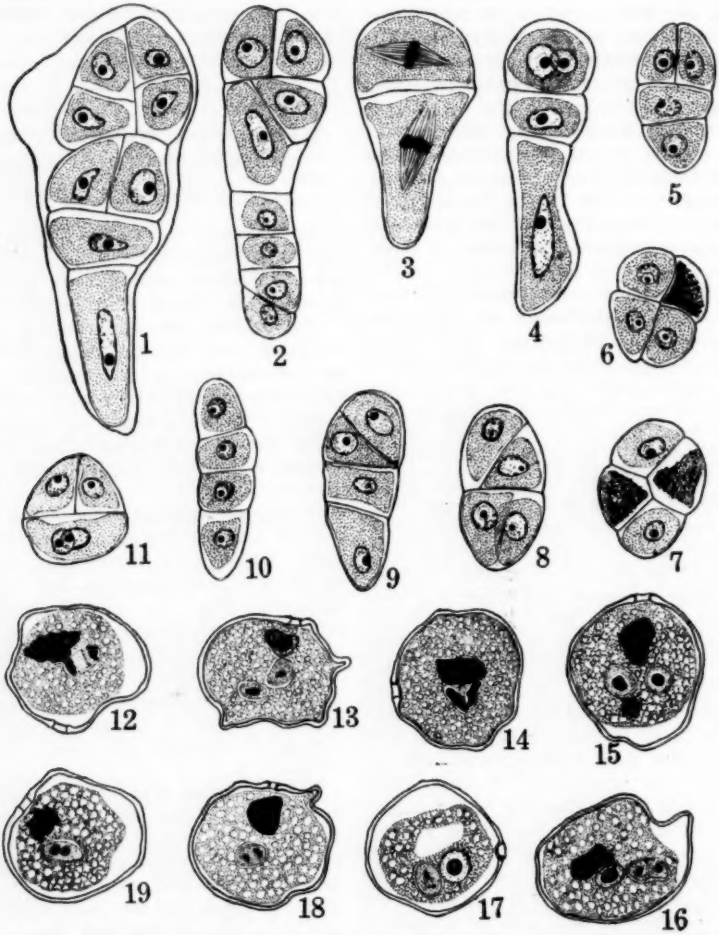
The pollen mother cells round up prior to meiosis and the divisions are of the successive type. Usually the tetrads are isobilateral or tetrahedral in arrangement. But linear (Fig. 10), decussate (Fig. 11), and T-shaped (Fig. 5), tetrads are also frequently formed in the same loculus. The occurrence of all the above five types of dispositions of the microspores in one and the same species has not been reported hitherto in any of the grasses though recorded for certain monocots like *Musa*,[1] *Habenaria*[2] and *Ottelia*.[3]

In a few cases, less than four microspores are formed. This may be due to the failure of Division II in one of the dyad cells, or one or sometimes two microspores of a tetrad become non-functional and degenerate *in situ* (Figs. 6 and 7). Generally the microspores of a tetrad are of a similar size and shape; but in some cases marked size differences are noticeable. One or two spores may be smaller or one may be considerably elongated than the others (Fig. 4). This is so especially in the T-shaped tetrads. The pollen mother cells destined to give rise to these tetrads can be spotted even at early prophase, for instead of rounding prior to meiosis, such cells become elongated and swollen at one end so as to present a club-shaped appearance. The nucleus of the mother cell occupies the swollen end and the first meiotic

division results in two dyads of unequal size. Fig. 3 shows division II in such dyad cells.

In still others oblique wall formation occurs on the completion of meiosis II resulting in an isobilateral tetrad consisting of microspores of two different sizes or only one of the dyads may show an oblique division (Figs. 8 and 9).

Usually the tetrads are free from one another when formed, but sometimes they show a tendency to remain united. Thus two tetrads may remain closely appressed to each other resulting in an association of eight cells. Such a condition probably arises from the development of two pollen mother cells lying in close juxta-



FIGS. 1 and 2. Union of two tetrads showing dissimilar arrangement of microspores; FIG. 3. Division II in dyad cells; FIGS. 4 and 5. T-shaped tetrads: note size differences of microspores in Fig. 4; FIGS. 6 and 7. Tetrads showing degenetation of either one or microspores; FIGS. 8 and 9. Tetrads showing oblique wall formation between microspores in the upper dyad; FIGS. 10 and 11. Linear and decussate tetrads. FIG. 12. Division in generative cell; FIG. 13. Three-celled pollen grain; FIG. 14. Pollen grain at shedding: note the degenerated tube nucleus; FIGS. 15 and 16. Pollen grains showing more than three nuclei; FIGS. 17 to 19. Generative cell undergoing division without cell plate formation. × 715.

position without separation. Variations in the arrangement of the microspores in such twins are also noticed. One may have a tetrad of one type and another of a different type (Figs. 1 & 2), or both may show similar arrangements.

To sum up, a somewhat striking parallelism is seen in the behaviour of the pollen mother cells and the megaspore mother cells not only in the formation of the various kinds of spore tetrads but also in the non-functional character of some of the spores of a tetrad.

The pollen grains are three-celled at the time of shedding (Figs. 12 to 14). The vegetative nucleus is always found in an advanced stage of degeneration and takes a deep stain. Occasionally, however, supernumerary nuclei are observed in the pollen grain. These can arise from divisions of either the vegetative or the generative nucleus (Figs. 15 & 16). A similar condition occurs in *Sorghum vulgare*[4] and in other grasses like *Panicum* and *Paspalum* (author's unpublished observations).

A new feature is that during the division of the generative cell the two chromosome sets may move apart to the poles without the formation of an intervening cell plate. Such cells show two nucleoli of equal size lying side by side within a common nuclear membrane (Figs. 17 to 19). It further appears that there may be no strong metaphase contraction of the chromosomes so that the resulting nucleus is diploid in constitution. The phenomenon is intranuclear and suggests a type of endodupication of the chromosomes as recorded in the tapetal cells of *Spinacia*.[5] The formation of such cells, though sporadic, may be seen in the same loculus along with the normal pollen grains.

I am not aware of the occurrence of similarly originating and apparently diploid male gametes in other plants. Fertilization of a haploid egg through functioning of such a diploid male gamete may be one of the methods of origin of autotriploids such as have been recorded in *Saccharum spontaneum* and *Pennisetum typhoides*, although usually they are believed to arise either by a fusion of two male gametes with the egg or due to non-reduction during megasporogenesis.

My grateful thanks are due to Prof. P. Maheshwari for kindly going through the slides and for many helpful suggestions in the preparation of this note.

Dept. of Botany, S. Narayanaswami.
University of Delhi,
Delhi,
October 4, 1951.

1. Juliano, J. B. and Alcala, P. E., *Philippine Agr.*, 1933, **22**, 91-126. 2. Swamy, B. G. L., *Proc. Natl. Inst. Sci.*, India, 1946, **12**, 413-26. 3. Islam, A. S., *J. Indian Bot. Soc.*, 1950, **28**, 79-91. 4. Artschwager, E. and McGuire, R. C., *J. Agri. Res.*, Washington, 1949, **78** (12), 659-73. 5. Witkus, F. R., *Amer. J. Bot.*, 1945, **32**, 326-30.

MAGNETIC STORM EFFECTS ON THE F-LAYER OF THE IONOSPHERE

The effect of magnetic storms on the ionosphere has been studied by the pulse method at vertical incidence by several workers,[1,2] particularly by Wells, Watts and George and Lindquist. These investigations show the existence of ionic clouds in the F-layer of the ionosphere moving in and out rapidly with velocities of the order of 1 to 2 km./sec. Evidence of the existence of such ionic clouds in the F-layer is obtained during a study of the fading patterns of the shortwave signals during periods of magnetic disturbances and particularly during the magnetic storm on March 7, 1951, when a storm of moderate severity was reported by observatories[3] all over the world [Kodaikanal reported international character Fig.-2]. The fading records obtained are chiefly of the AIR transmission from Madras on a frequqency of 9,590 kc./s. from 1300 hrs. to 1500 hrs. I.S.T. The transmitter-receiver (Madras—Waltair) distance is 600 km. During this period the propagation is *via* the F-layer.

Below is reproduced the fading record obtained on the 7th March between 1300 hrs. to 1500 hrs. which shows a type of fading that is not observed on normal days. The record shows a periodic and violent fading. Closer examination, however, reveals some interesting features. As is seen, the frequency of fading is 2 to 3 cycles per minute at the beginning of the record, and this increases gradually to a value of the order of 60 c.p.m. and greater, in about 13 minutes. This sequence is, however, then reversed and the cycle repeated. In fact, in the 2-hour record this occurred 4 times. The very close similarity between the sequences is remarkable.

The presence of the ionic clouds in the F-layer during a magnetic storm produces rapid and sudden changes in F-layer ionisation and heights and the F-layer is in a state of turbulence.[1] If then a radio wave is incident on the F-layer this will experience Doppler fading at the point of reception as the "point" of reflection in the F-layer will be subject to oscillation

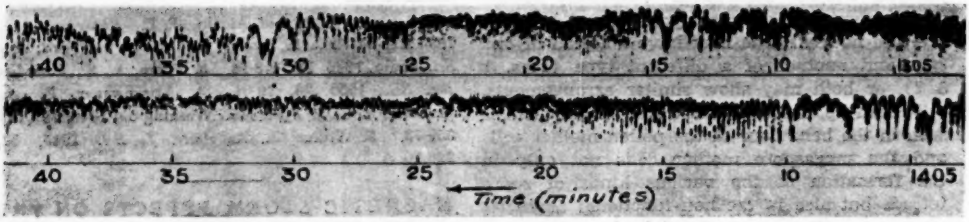


Fig. 1. Record of the fading pattern of A. I. R. Madras transmissions on 9590 kc/s., from 13^h00^m to 15^h00^m I. S. T. obtained during the magnetic storm on March 7th, 1951.

in a vertical sense owing to the sudden and rapid changes in the vertical gradient of ionisation. The fading reported here, though it resembles the Appleton-Beynon fading,[4] is not due to interference between the magnetoionic components but is to be ascribed to the undulations of the point of reflection at the F-layer. The sequence of the change in fading frequency is then to be attributed to a drift in the mean position of the point of reflection. This may be produced by F-layer turbulence of larger scale or a gradual change in the layer height. Thus an increase in the fading frequency indicates a downward motion of the layer while a decrease indicates an upward movement. Ionic clouds in the E-layer may have some effect on the period of fading but these alone cannot account for the observed fading. Complete details will be published shortly.

The author wishes to record his grateful thanks to late Dr. N. S. Subba Rao for his kind interest in the author's work. His thanks are also due to Prof. K. R. Rao for giving the necessary facilities and to Dr. A. K. Das, Director, Solar Observatory, Kodaikanal, for furnishing the necessary data on magnetic and solar activity.

Wireless Research Lab., Y. V. SOMAYAJULU.
Physics Department,
Andhra University,
Waltair,
October 29, 1951.

1. Wells, H. W., Watts, J. M. and George, D. E., *Phys. Rev.*, 1946, **69**, 540. 2. Lindquist, R., *Archiv. f. Geophy.*, 1951, Band I, No. II. 3. —, *Journal of Geophysical Research*, 1951, **56**, (2), 289. 4. Appleton, E. V. and Beynon, W. J. G., *Proc. Phys. Soc.*, 1947, **59**, 58.

IODOFORM REACTION WITH JUTE CELLULOSE

A VARIETY of organic compounds originally containing no keto groups yield haloform when treated with halogen and alkali under specified conditions.[1,2] Huebner and Sinha[3] first obtained iodoform from cellulosic materials, silk, wool and rubber, etc., by treatment with iodine and 17·5% NaOH followed by steam distillation.

In the course of some experiments here on the absorption of iodine by jute cellulose and cotton from KI solution, in presence of alkali, iodoform was smelt in the reaction mixture, after titration of the available iodine with thio. This obviously suggested that cellulose was oxidised by iodine, with scission of the chain, even in the mild conditions, to give the iodoform reaction. A little of the cellulosic material—jute fibre, holocellulose, alphacellulose and hemicellulose, was taken in a stoppered conical flask, covered with dilute solution of iodine (N/50) in KI and NaOH (N/2) added drop by drop, till the colour and odour of iodine were discharged on thorough shaking, and kept for sometime at ordinary temperature. The characteristic and unmistakable smell of iodoform was perceptible. The contents of the flask were shaken with a few drops of aniline, warmed and kept for a while. The offensive smell of carbylamine confirmed iodoform. The same results were obtained by the use of KI and NaOCl, and with glycerine and starch paste. Iodoform reaction with holocellulose, using NH_4OH instead of NaOH, was also positive. This shows according to Schwinkler reaction[4] (formation of iodoform in presence of ammonium hydroxide) that one of the products of oxidation of cellulose by iodine, even under mild conditions, is a compound containing CH_3-CO-C-group. AR chemicals were used in the experiments. Details will be published elsewhere.

Thanks are due to Dr. P. B. Sarkar, Director, for his interest in the work.

Technological Res. Labs., H. CHATTERJEE.
Indian Central Jute Committee,
Tollygunge,
Calcutta 33,
November 5, 1951.

1. Slotta and Neisser, *Ber.*, 1938, **71B**, 1611. 2. Kratzl, *et al.*, *C.A.*, 1950, **44**, 325. 3. Huebner and Sinha, *J. Soc. Chem. Ind.*, 1923, **42**, 255T; *Ibid.*, 1922, **41**, 93T. 4. Edwin Rothlin. *C.A.*, 1941 **35**, 5091.

REVIEWS

Mathematical Engineering Analysis. By R. Oldenburger. (Macmillan & Co., New York), 1950. Pp. ix + 426. Price $ 6.

The book under review is quite unique in the field of engineering mathematics and will be of great use to engineers and industrial physicists interested in expressing physical situations mathematically. It is made up of five parts: Mechanics of Rigid Bodies, Electricity and Magnetism, Heat, Elasticity and Fluid Mechanics. In each of these, the fundamental theory is set out clearly in mathematical form and with this as background, physical problems in different branches of engineering are treated mathematically. The solution of these physical problems is then illustrated by making simplified assumptions. Problems are presented at the end of each section so that the reader might obtain practice in setting up physical systems in mathematical form.

This book can be ideally used as a text-book on engineering analysis by students with a knowledge of advanced calculus and will be indispensable to everyone engaged in industrial research and also to mathematicians interested in obtaining an acquaintance with the fundamental concepts of engineering.

A. R.

Machine Shop Mathemetics. By Aaron Axelrod. Second Edition. (McGraw-Hill), 1951. Pp. xi + 359. Price $ 3.60.

The complexity of modern industry makes very exacting demands on the technical knowledge of the skilled mechanic. A good grounding in arithmetic, algebra and trigonometry is one such and the book under review is intended to present aspects of these branches required by machine shop students and apprentices and also related information on machines, attachments, tools, metals and shop procedures. It is extremely self-contained and the practical aspects are always kept to the forefront. The book starts from simple arithmetic such as fractions, weights and measures, etc., but leads up to various results in geometry and trigonometry, such as solution of triangles, and various geometrical constructions. The last four chapters deal with speeds and feeds in various machines, lathe work such as cutting tapers, screw threads and worms, cutting gears of various types and finally milling machine work. However, there seems to be no mention of dividing machines and methods of graduating scales and constructing verniers; but this is only a minor omission. It is to be hoped that machine shop apprentices in our country would be given as thorough a grounding in mathematics as is presented in this book, and it can therefore be warmly recommended to all instructors in workshops. The book is moderately priced, considering the quality of the contents and the excellent printing and get-up.

Partial Differentiation. By R. P. Gillespie, (Oliver and Boyd), 1951. Pp. viii + 105. Price 6 *sh.*

This booklet is a new addition to the University Mathematical Texts edited by Aitken and Rutherford. It is comparatively elementary and forms an introduction to the subject of partial differentiation to those familiar with the differentiation of functions of a single variable. The first chapter contains a definition of a partial derivative and the conditions for its existence. This is followed by a chapter on change of variable, the Jacobian, Hessian, Partial and Complete Differentials, etc. The third chapter deals with Taylor's theorem for a function of several variables and its applications to curves and surfaces. The final chapter is devoted to problems of maxima and minima in functions of n-variables. In particular, it includes an account of Lagrange's method of undetermined multipliers, which finds application in various types of problems. The book contains also a number of examples for being worked out. It will be found useful by students who wish to get acquainted with methods of partial differentiation.

Photosynthesis and Related Processes. Vol. II, Part I. By Eugene I. Robinowitch (Interscience Publishers Inc., New York), 1951. Pp. xi + 603 - 1,208. Price $ 15.

Part I of the second volume on photosynthesis compiled by the author deals with the spectroscopy and fluorescence of photosynthetic pigments and kinetics of photosynthesis. Ever since the classical researches of Willstatter and Stoll on leaf pigments and their relation to carbon dioxide assimilation, there has been so rapid

an advance in our knowledge on this aspect of photosynthesis that it has changed the outlook of the whole field of this problem. A very extensive literature containing some very conflicting results has now accumulated on the absorption spectra of pigments, the light absorption by pigments in a living cell and the fluorescence of pigments *in vivo* and *in vitro*. The author has summarised the numerous findings in a concise and critical manner.

The remaining portion of the book deals with the kinetics of photosynthesis and the three chapters on light factor make a very illuminating reading. They produce a vivid picture of the complex nature of the process which was illustrated thirty years ago by the simple equation that carbon dioxide and water in the presence of sunlight were converted into carbohydrates. Though we are still far from understanding how such transformation is effected in a living cell, very useful knowledge has already been gained.

The book is intended to give useful guidance to those who wish to tackle any aspect of this all-important process. It is also well illustrated. The author has rendered a great service in presenting in a very able manner the up-to-date inormation on photosynthesis.

R. H. DASTUR.

Evolution. By A. Franklin Shull. (McGraw-Hill Book Company Inc., New York, Toronto & London), 1951. Second Edition. Pp. vii + 322. 141 Text-figures. Price not mentioned.

The first edition of Shull's *Evolution* was written about a decade and a half ago and attempt was then made to give a general account of evolution resting on a genetic background. Its scope was then limited practically to the evolution of animals, but this omission has been set right in the 2nd edition. An account of polyploidy is now also given.

Though, to some extent, this book can be helpful to the trained biologist, it is primarily written for students. For this reason, chapters giving the classical types of evidence for students are included so that they should know why evolution has happened and why it is now believed to be a fact by a majority of the people. Though these evidential chapters have also been moderately changed in the 2nd edition, the author has practically rewritten the rest of the book and nearly three-fourths of the illustrations are new. Throughout the revised edition also the author has always kept genetics everywhere in the forefront.

The author has given a brief history of the idea of evolution in the first chapter and towards the end, in the chapter on organization of human and other animal societies. The "Origin of Life" is the subject-matter of the last chapter.

The author has avoided bibliographies, as citations of research articles and names of authors, from the student's point of view, may give the book a choppy appearance. There is, however, a good subject-index, covering 24 pages, at the end and this provides an analytical key to the whole work.

Though the reviewer does not believe in laying so much emphasis on genetics as an explanation for evolutionary processes and is, in fact, himself a believer in the adaptiveness of living things, he has found the work very useful for a general grasp of the intricate theories of evolution and for understanding the modern trends in studying them. The work can be specially helpful to students who have yet to be initiated in the study of general biological phenomena.

S. L. H.

Alcohol—A Fuel for Internal Combustion Engines. By S. J. W. Pleeth. (Chapman & Hall), 1945. Pp. xv + 259. Price 28 *sh.* net.

The problem of suitable liquid fuels for internal combustion engines has attained urgent importance in the face of the discouraging fact that our reserves of the two well-known and irreplaceable sources of fuel—coal and petrol—are getting depleted at an alarmingly rapid rate. The fuel consumption for 1950 is estimated to exceed 400 million tons and the imperative need for exploring alternative sources of fuel has arisen.

Alcohol—known to man for ages in the form of fermented liquors—offers prospects of constituting an ideal source of a perennially renewable fuel. This source would last as long as the sun continues to shine and the chlorophyl plants capture sun's energy and store it in the form of carbohydrates. There are tremendous possibilities of augmenting the world's production of alcohol.

The seventeen chapters which comprise the present volume are devoted to a critical and clear presentation of this potential and replaceable source of liquid fuel for various types of internal combustion engines. There is a very useful discussion (Chapter V) on the important subject of knock. Detailed analysis of the fuel requirements of motor cars, racing cars and aeroplanes are presented in a series of three

chapters (6, 7 and 8). The ninth chapter deals with water-tolerance of alcohol while the tenth gives some of the important properties of alcohol pertinent to its status as a fuel, *e.g.*, calorific value, volume changes on blending, spontaneous ignition temperature, flash point, etc. Illumination data on cylinder wear, corrosion and gum formation, are given in the succeeding three chapters.

There have been many unfavourable reports repeatedly levelled against alcohol as a fuel,—mostly from powerful interests who own or control rich oil deposits. Countries which have little or no oil, have favoured alcohol as a fuel. The author of this volume has presented "the case for and against alcohol in general terms" in the light of the experience gained in many countries. He has shown how the conclusions have been influenced by political and economic considerations. The last chapter on planning for the future makes interesting and instructive reading. The author is an enthusiastic advocate of alcohol, whose production would subsidise and enrich agriculture. For an agricultural country like ours, whose oil resources are poor, this volume has a special appeal. This is a book which should be widely read not only by those interested in the subject of alcohol as a fuel but also by the economists and the administrators interested in the economic regeneration of this country.

The Enzymes, Chemistry and Mechanism of Action. Vol. I, Part I. Edited by James B. Sumner and Karl Myrbäck. (Academic Press Inc., New York), 1950. Pp. xvii + 724. Price $ 13.50.

Enzymology occupies a strategic and pivotal position in the domain of biological sciences. All vital phenomena associated with the living cell are largely mediated and controlled by enzymes. There have been continued, intensive and many-sided attempts at an understanding of the chemical nature of these intriguing entities in relation to their catalytic function; the results so far obtained, while illuminating many facets of the problem, have added little to a clarification of their structure and mechanism and specificity of their action. In recent years, the new techniques and instruments which have been developed have been pressed into service for elucidating the problem and there has been enormous output of research achieved in this field.

The editors of this monumental series of volumes, both distinguished for their brilliant contributions to enzymology, have taken upon themselves the difficult task—"to gather and sift available knowledge, present it in an orderly fashion and try to utilise it for the advancement of enzymology". Their commendable aim is "to present systematically the accumulated knowledge in the various phases of enzymology as a comprehensive survey which will be of the most efficient service both to those already working in the field and to those preparing to enter it". In the successful accomplishment of this endeavour, the editors have been able to secure the co-operation of seventy-eight of their colleagues—each an authority on the subject concerned.

The series has been planned to be issued in two volumes, each volume consisting of two parts. The volume under review consists of 19 chapters covering (1) Introduction by James Sumner and Karl Myrbäck, (2) The Physical Chemistry and Chemical Kinetics of Enzymes, by E. A. Moelwyn Hughes, (3) Enzyme Specificity, by Burckhardt Helferich, (4) Enzymes in Relation to Genes, Viruses, Hormones, Vitamins and Chemotherapeutic Drug Action, by M. G. Sevag, J. S. Gots and E. Steers, (5) Cytochemical Foundations of Enzyme Chemistry, by A. L. Dounce, (6) Modern Aspects of Enzymatic Adaptation, by S. Spiegelman, (7) Enzyme Inhibition, by L. Massart, (8) Enzymes and Immunology, by J. R. Marrack, (9) Enzymes Hydrolysing Fats and Esters, by R. Ammon and Maire Jaarma, (10) Acetyl Choline Esterase and Choline Esterase, by Klas-Bertil Augustinson, (11) Phosphatases, by Jean Roche, (12) Metaphosphate and Its Enzymatic Breakdown by Bjorn Ingleman, (13) Sulphatases, by Claude Fromageot, (14) Invertase, by Carl Neuberg and Ines Mandl, (15) α-D-Glucosidases, by A. Gottschalk, (16) β-Glucosidase, by S. Veibel, (17) Hydrolysis of Galactosides, Mannosides and Thioglycosides, by S. Veibel, (18) β-Glucuronidase, by W. H. Fishman and (19) Amylases and Hydrolysis of Starch and Glycogen, by K. Myrbäck and G. Neumüller.

It will be seen that the first eight chapters are devoted to a discussion of the general aspects of enzymology. The succeeding chapters deal specifically with some of the individual enzymes. The editors have not been able to consider it either "necessary or even appropriate" to include a comprehensive survey of practical methods used in enzymology. It is, however, felt that a third volume devoted to a discussion of the practical methods would add

greatly to the usefulness and completeness of this remarkably well-conceived and ably executed series of volumes on enzymology.

Styrene. By A. L. Ward and W. J. Roberts. Edited by E. R. Blout and H. Mark. (Interscience Publishers, Inc., 250, Fifth Avenue, New York 1, N.Y.), 1951.

The monograph is a revised and enlarged edition of the previously published section on Styrene, in the Monomers series. It begins with brief chapters on the preparation of the monomers, their laboratory as well as commercial, purification from impurities, by-products, analysis and methods of handling them. Data from recent literature on the physical, chemical and thermodynamic properties of styrene have been given. The chapter on polymerization and copolymerization will serve as a useful guide to any one working in this field. Particular attention has been paid to copolymers that have commercial values. The monograph also contains a report of recent work on copolymers produced by mass polymerization, solution polymerization and emulsion polymerization.

The bibliography is comprehensive and includes 201 references, most of which refer to latest literature.

The monograph has been admirably written and will serve as an excellent supplement to the Monomers Series.

M. S. MUTHANNA.

Books Received

Elsevier's Encyclopædia of Organic Chemistry, Series III, Vol. 14, Supplement. Edited by F. Radt. (M/s. Elsevier's Publishing Co., London, W. 1), 1951. Pp. xxxi + 938. (Index 113). Price not given.

Advanced Five-Figure Mathematical Tables. By C. Attwood. (M/s. Macmillan & Co. Ltd.), 1951. Pp. v + 69. Price 4 *sh.* 6 *d.*

Advances in Genetics, Vol. IV. Edited by M. Demerec. (M/s. Academic Press Inc.), 1951. Pp. ix + 343. Price $ 7.50.

Sound Insulation and Acoustics. By Per V. Bruel. (M/s. Chapman & Hall), 1951. Pp. xii + 275. Price 35 *sh.*

Experimental Spectroscopy, Second Edition. By R. A. Sawyer. (Chapman & Hall), 1951. Pp. x + 358. Price 30 *sh.*

Nomographic Charts, First Edition. By C. Albert Kulmann, (M/s. McGraw-Hill Book Co.), 1951. Pp. xii + 244. Price $ 6.50.

Physiology of the Fungi, First Edition. By Virgil Greene Lilly and Horace L. Barnett (M/s. McGraw-Hill), 1951. Pp. xii + 464. Price not given.

Bacterial Physiology. By C. H. Werkman and P. W. Wilson. (M/s. Academic Press), 1951. Pp. xiv + 707. Price $ 8.50.

Vitamins and Hormones (Advances in Research and Applications), Vol. IX. By Robert S. Harris and Kenneth V. Thimann (Editors). (M/s. Academic Press), 1951. Pp. xii + 395. Price $ 8.00.

Further Laboratory and Workshop Notes. Edited by Ruth Lang. (M/s. Edward Arnold & Co.), 1951. Pp. xii + 290. Price Rs. 28.

SCIENCE NOTES AND NEWS

Ophioglossum vulgatum

Sri. A. S. Mehta, Dept. of Botany, Science College, Patna, writes as follows:

Several specimens of *Ophioglossum vulgatum* L. were collected from Purnea (Bihar), and this constitutes yet another record of its occurrence. The specimen differs from other reported materials of the same species in possessing 2 to 4 leaves on the rhizome. The maximum number of leaves recorded uptil now is 3. None of the specimens shows a monophyllous habit.

Indian Phytopathological Society

The following were elected to the Council for the year 1952:

President: Dr. B. B. Mundkur, Poona; *Vice-President*: Dr. R. P. Asthana, Nagpur; *Councillors*: Dr. A. P. Misra, New Delhi; Dr. P. R. Mehta, Kanpur; Prof. S. R. Bose, Calcutta; Dr. M. L. Gattani, Bharatpur; Dr. M. K. Patel, Poona and Mr. K. M. Thomas, Mysore State; *Secretary-Treasurer* (1950-52): Dr. R. Prasada, New Delhi.

Indian Botanical Society

The following Office-bearers have been elected for the year 1952:

President: Dr. K. Biswas, Calcutta; *Vice-Presidents*: Dr. P. Maheshwari, Delhi, and Dr. R. K. Saksena, Allahabad; *Hon. Secretary*: Dr. R. Misra, Sagar; *Treasurer*: Dr. R. L. Nirula, Amraoti; *Editor-in-Chief*: Dr. A. C. Joshi, Jullundur City; *Business Manager*: Dr. T. S. Sadashivan, Madras.

Burmah-Shell Scholarships

In recognition of the work done by the CSIR during the war, particularly in connection with the utilization of vegetative oils as lubricants, the Burmah-Shell have offered an annual donation of Rs. 1 lakh to be divided as follows:

(1) Rs. 50,000 per year for Scholarships at Loughborough College in the U.K. The proposal is to provide means of sending to U.K. two students a year at an approximate cost of £ 450 each, so that from the 4th year onwards there will always be 8 students a year in the U.K.

(2) Rs. 50,000 a year for open research scholarships to the Commonwealth, the planning and operation of the scheme to be in the hands of the Ministry of N. R. and S. R. in collaboration with Burmah-Shell.

The Burmah Oil Company have also offered a donation of Rs. 1 lakh per annum to be applied to the granting of scholarships to young men wishing to go to the U.K. for scientific and technical training aimed at fitting them for posts in industry, especially that relating to oil in India.

Ford Grant to Pakistan

A grant of $ 1,600,000 to set up a Polytechnic Institute and a Domestic Science College in Pakistan has been made by the Ford Foundation.

Trade Name Index of Industrial Diamonds

The Industrial Diamond Information Bureau and the Industrial Diamond Review have compiled a highly useful index of industrial diamonds for the year 1951-52. Copies can be had at 3 *sh.* 6 *d.* each from the publishers: N. A. G. Press Ltd., 226, Latmyer Court, Hammersmith, London W. 6.

Symposium on I. C. Engines

A Symposium on Problems in the Development of Internal Combustion Engine Industry in India is to be held under the joint auspices of the Internal Combustion Engines Research Committee of the Council of Scientific and Industrial Research and the Indian Institute of Science in Bangalore for two days about the end of March 1952.

The Committee intend publishing the papers presented at the Symposium in the form of a monograph. Intending contributors are requested to send their papers with a short abstract before 1st February, 1952, to S. N. B. Murthy, Secretary, Internal Combustion Engines Research Committee, c/o The Director, Indian Institute of Technology, 5, Esplanade East, Calcutta 1.

Out-of-Print Periodicals

Information can be had from the Libraries Division of the Science Co-operation Office, New Delhi, regarding the availability of periodicals which have been out-of-print, but which have now been reproduced in printed, microfilm or microcard form. This list does not include titles of periodicals microfilmed and held by libraries for which the right of reproduction and sale is not also held. Also readers are requested to send to the Libraries Division of UNESCO the titles of periodicals which they know to be out-of-print and for which there is a long-felt need. It may be possible for UNESCO to arrange to have such out-of-print issues reproduced and made available.

Edible Casein from Spoilt Skim Milk Powder

The Central Food Technological Research Institute, Mysore, has developed a simple and inexpensive process for the manufacture of edible casein from spoilt skim-milk powder. It is estimated that a ton of milk powder can be processed to yield about a third of its weight of good quality casein, at a cost roughly of Rs. 400.

Award of Research Degree

On the recommendation by an Examiners' Board consisting of Prof. M. L. Olephant, F.R.S., Prof. Sucksmith, F.R.S., Prof. E. J. Bowen, F.R.S., and Prof. H. J. Taylor, the Degree of Doctor of Philosophy in Physics of the Banaras Hindu University was conferred on Mr. B. R. Marathe for a thesis entitled "Studies of Joshi Effect Near Threshold Potentials".

CORRECTION

Vol. 20, No. 12: In the article on "Metabolic Interrelationships between Folic Acid and Vitamin B_{12}," the values for urinary N'-methyl nicotinamide (Table II, p. 320) should be in *gammas* and not in mg.

Secretary: M. Sreenivasaya, B.A., F.I.I.Sc., F.A.Sc. Editor: G. N. Ramachandran, M.A., Ph.D. D.Sc., F.A.Sc.
1950-51 Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent and Published by Dr. M. A. Govinda Rau, M.A., Ph.D., for the Current Science Association, Bangalore

ANNOUNCEMENT

JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH

To accommodate the large number of original research papers coming in for publication and to facilitate speedy publication of such papers, the number of pages in the Journal has been increased from 64 to 100 from January, 1952.

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